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GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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By A. Y. HENDRICKSON,

Chemist to the South Suburban Gas Company; Fellow of the Chemical Society; Associate Member of the Institution of Gas Engineers.

This volume represents an endeavour to review the literature, published during the past year, that is of interest to those engaged in gas-works laboratories. A feature of the work is a bibliography, which facilitates reference to the literature summarized in the book.

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VOL. CXXXVII., No. 2801.] TUESDAY, JANUARY 16, 1917. [69TH YEAR.

EDITORIAL NOTES.

The Chemical and the Gas Industries.

Two notable pieces of intelligence appeared in the "JOURNAL" last week, which invite watchfulness on the part of the National Gas Council. For some months past, items of information have been published concerning the formation of the Association of British Chemical Manufacturers; but we are a little bit dubious as to whether gas undertakings that are not chemical manufacturers on the large scale would be eligible for membership. There is also the proposal for the formation of a National Association of Sulphuric Acid Makers, in regard to which we may have something more to say on another occasion. Meantime, readers may be reminded that among the ideas of the author of the scheme is that an object of the Association shall be to prevent "superfluous and speculative" spending of additional capital in the production and trading in sulphuric acid, which is an important necessary in one of the gas industry's own manufactures as well as in numerous others in the country. This large use makes the cheapness produced by an open market a matter of considerable national importance. Moreover, the gas industry being its own customer for the acid, this, so far as it is concerned, removes the main element of speculation upon which the proposer of the scheme lays so much stress. In the past, there has been a good deal of evidence as to the amiable intentions of the chemical manufacturers in regard to the gas industry, which is the source of much of their requirements, and therefore a source which (so they think) should have outlets only in the direction of themselves. We have seen this clearly throughout their parliamentary campaign. Therefore we repeat the suggestion that the National Gas Council should look into the new developments, actual and proposed, to precisely ascertain their objects, and see what action (if any is required) should be taken within the gas industry in reference to them. Which reminds us that, though the gas industry is fundamentally a chemical one, and produces considerable quantities of the materials that are needed by chemical manufacturers, it has no technical organizations of its own on the chemical side, other than those that look after its commercial sulphate of ammonia interests and partially its coke interests. This is a point that is worth the consideration of the National Council in conjunction with the Institution of Gas Engineers.

The paragraph that appeared last week (p. 71) announcing the registration of the Association of British Chemical Manufacturers mentioned that one object is to promote co-operation between British subjects engaged as manufacturers in the chemical and closely allied industries. This statement is very general, and very vague. Is the gas industry regarded as a "closely allied industry?" If so, are the chemical manufacturers proposing to promote co-operation between themselves and the gas industry? This would indeed be quite a new policy on their part; for there has hitherto been no indication whatever of it. On the contrary, there have been the attempts to secure indirect protection for the chemical manufacturers by depriving the gas industry of its freedom, and putting the latter to tremendous expense and trouble in the defence of its legitimate rights and privileges, and its natural lines of development. We see that one of the first members is Mr. Charles Carpenter, D.Sc., who was the President of the Society of Chemical Industry when this scheme was first broached. It is true that the South Metropolitan Gas Company are already large chemical manufacturers, having up to 1912 spent something like a quarter of a million on this branch of their business. But the Chairman of the South Metropolitan Gas Company is by professional training and practice first a gas manufacturer, and, secondly, a chemical manufacturer; and he, at all events, can be depended upon to do his share in seeing that the liberties and privileges of the gas industry are in no wise affected by the work of the new Association, though (so far as we are aware) in the new organization he at present stands alone in the dual capacity which includes of the one part representation of the gas industry. The whole tenour, too, of his evidence in November, 1912, before the Joint Select Committee of the two Houses on Gas Residual Products was that, in his opinion, it would be to the disadvantage of consumers of gas if the tar market was confined to the chemical manufacturers, who possibly might agree the price. "In the past," he categorically said, "it had been a disadvantage, under "which the consumers of gas had suffered." In the matter of gas-works residuals, free trading and manufacture were his confessed principles; and we know Mr. Carpenter well enough to believe that he would have nothing to do with any organization if its work was in any way likely to assail the interests of the gas industry.

Then it is observed that another object of the Association is to place before Government officials and others, either in the British Dominions or elsewhere, the views of the members of the Association and others upon matters affecting the chemical industry. Before the Association came into being, the gas industry had pretty good evidence that there was no lack of means of communication from the side of the chemical manufacturers so far as our own Government and its officials are concerned. Another object is to develop technical organization, which is very praiseworthy; as is also the promotion of industrial research, industrial efficiency, and the advancement of applied industry. It is further seen that one of the proposals in connection with the working of the new organization is that there shall be Group Committees, each consisting of not less than three members. One of these Committees will deal with the distillation of coal, shale oils, wood, alcohol, acetone, coal tar, primary products (including ammonia and ammonia products), charcoal, and fuel. It seems there is work here which rather belongs to some other industries—such as coal distillation—and upon which there appears to be little title on the part of the chemical manufacturers to trespass, unless they consider they can carry out an investigation into coal carbonization better than the gas industry, which admittedly has not, through its principal technical organization, set a very high standard in this particular respect.

We dealt pretty fully last week (p. 57) with the proposal to establish a National Association of Sulphuric Acid Makers. But in connection with it, it is of interest to recall that Mr. Carpenter, in his evidence before the Joint Committee in 1912, also indicated that, producing sulphur to the extent the gas industry does, it would be quite a natural thing for it to become its own manufacturer of sulphuric acid. He agreed as to the expensiveness of the plant, and that its location is important, but said that it was quite natural that small gas companies who could not have such a plant should sell their sulphur to a gas company who could. He thought that the production and supply of sulphuric acid should not, in the interests of the industry generally, be in any way limited; and that it would be of advantage to the industries and the country generally to have cheap sulphuric acid. He likewise considered that free trading in, and treatment of, gas residuals was more a consumers' question than any variation in the amount of the profits that could be made by the alkali people. So far so good. In the Association of Chemical Manufacturers (we wonder

whether this will supersede that—to the outside world—mysteriously constituted Alkali Manufacturers' Association), the gas industry has a good representative in the witness who in 1912 professed the principles here referred to. At the same time, the gas industry should see to it that its organizations are equipped in a manner requisite to meet the development of organization in other directions.

Crude Benzol and a Lasting Peace.

THE world has been talking more of peace than of war since the Kaiser launched his attempt to secure a premature Peace Conference before the conditions were ripe for such a step according to the Allied view. The War Lord has been informed of the opinion of the Allies; and his decision is that the war shall go on. This happens to have been the determination of the Allies before he made his ridiculous autocratic pronouncement. There will be no peace until the Allies are in the unchallengeable position of dictators. Let Germany and Austria be the dictators, or able to negotiate for peace with the Allies on equal terms, then the latter will not get what they have been fighting for—a lasting peace, the protection of the rights of small nations (such as those whose countries have been ravished and made the fields of unutterable carnage by the enemy), an assurance that treaties between nation and nation will be honourably observed, and compensation and reparation be made. Let Germany and Austria be reduced to the position in which they must have peace at any price, then the allied nations become the dictators. In the reduction of Germany, Austria, and their puppets, Turkey and Bulgaria, to the condition and frame of mind in which the Allies will be the dictators, the force of high explosives—incongruous with peace as these may seem—is going to tell.

It is in regard to the attainment of this dominant position that the writer (using the pseudonym "Cricket") of a short article in another column makes his appeal for a maximum output of crude benzol by the oil-washing of gas. Boards of directors, committees, and engineers of gas undertakings must not be lulled into any feeling that the security of the allied countries and their cause is assured by the maximum production already obtained. Much more has yet to be done, and a good margin of safety has to be realized. The recognition of this in all things concerning the war is why we have a new business Government, why the man power of the country is being mobilized under a Director-General of National Service, why shipping and coal are being taken under the control of the Government, why the country is being made food-producing to a larger extent than formerly, and why a new unlimited War Loan has been floated. These happenings are big with significance. They mean that the last great struggle has yet to take place, that every nerve, fibre, and muscle in the national constitution has to be exercised in the great effort, and that every ounce of strength has to be applied. Fighting for its very existence, Germany, we must expect, will carry on the war with an intensity—and savagery—such as has never before been experienced, until the time of exhaustion is reached. Only the absolute deprivation of the power of the enemy countries to continue the struggle will herald a return of peace, the end of slaughter and destruction, and the opening of the gateways to a gradual realization of newly established normal conditions. This deprivation of power can only be effected in two ways—through the efficiency of the blockade by the Allied Navies, and through a power-destroying rain of shells and bombs. Therefore every possible contribution of the materials needed for the manufacture of high explosives must be made. There must be no weakness in this direction any more than in man and in gun power. The present supply of crude benzol must be displaced by the actual possible maximum output through every gas-works capable of doing so oil-washing its gas.

Where gas engineers have succeeded, let no other gas engineer confess himself as incapable of overcoming superficial difficulties. Small gas-works as well as large have demonstrated a capability of surmounting difficulty in their varied circumstances; and gas engineers who now speak of unconquerable difficulties must stand convicted out of their own mouths of incompetence in this matter if they cannot achieve what men in minor positions have done. Where there is the will there is a way in any properly equipped gas-works, even in those approaching the lower makes. But we would go further than this with before us the time of greatest intensity and strain in the war, and say that those boards of directors, committees, and engineers who do not exert themselves to do their utmost in the provision of crude benzol are, to the extent of their shortcomings, enemies to their country and to the Allied cause. That is the plain truth. There is another aspect of the matter. Some are doing their major part by oil-washing their gas; others are not. The *nom de plume*—"Cricket"—under which our correspondent writes will convey something to those who are not working to the full strength of their opportunities.

A Fertilizers' Committee.

AN Order was published last Friday, under the Defence of the Realm Act, giving the Food Controller (Lord Devonport) plenary powers regarding the control, requisitioning, purchase, treatment, transport, use, consumption, and much else, of materials of all kinds in any way related to foodstuffs—from production to distribution and consumption. Following upon this Order, there came the announcement that Lord Devonport had appointed a Committee to make all the arrangements necessary and expedient for the increase of supplies of fertilizers in the United Kingdom, and for controlling, so far as may be necessary, their output and distribution. Seeing that, in the case of sulphate of ammonia, output is a secondary result of other processes—in the main, gas production and metallurgical coke making—it is difficult to see how any Committee can, with all the powers conferred on the Food Controller, govern output. However, so far as data available help us to a conclusion, there will be very little reason to control the output. The regulation of distribution is another matter, and one which is of considerable importance to the gas and coking industries, with prices already fixed by the Board of Agriculture much below what would be the market value, and much below the prices for licensed export, if there were freedom in dealings. In the list of members of the new Fertilizers' Committee is the name of Prof. W. Somerville, D.Sc., who, it will be remembered, was not long since advocating in "The Times" the retention for home consumption of all the sulphate of ammonia made in this country, and its compulsory application to the land. Prof. Somerville, therefore, enters upon his work prepossessed by very definite views of the requirements, which are opposed to those of practical men who know the agriculturist and know the market, and the history of its movements. Compulsory use might be very beneficial to the country; but the result of complete retention of the whole make would be that (unless the new Fertilizers' Committee undertook to absorb the entire amount) there would again be an accumulation of stocks, and the makers would be deprived of the higher values above the home regulated ones that they are obtaining for the part of the production that is being exported under licence. It would be better to let home absorption develop by some other means.

Specification of Tar-Fuel Oils.

THE annual report of the Hon. Secretary of the Diesel Engine Users' Association (Mr. Percy Still) refers to the large amount of discussion that there has been during the past year regarding the use of tar oils as fuel in Diesel engines. This use has been brought about by the high prices of imported fuel oil, owing to the shortage of tank-steamers. When this matter of the substitution of tar oils was broached in this country after the outbreak of hostilities, there was considerable difficulty in securing quotations that did not vary largely, and for quantities sufficient to give the users all the assurance they require. But now there appears to be no trouble in these respects; for to-day several Diesel patrons are using tar oils, either with pilot ignition apparatus fitted to the engine or without. But still there is a belief, notwithstanding the good results obtained, and the economy achieved per unit of electricity generated—admittedly certain difficulties have to be met—that there is more to be learned regarding the employment of tar oils for power purposes, and that fresh methods of application may be developed that will raise efficiency.

There is one thing the users of Diesel engines should understand; and it is that the tar distillers having come to their rescue in this time of stress, some compact should be made which would encourage the distillers to permanently maintain their supplies. With the experience of the owners of Diesel engines as to the vacillations of the oil market, and as to their troubles in regard to supplies and prices since the war began, there should be no difficulty on their part in appreciating that their best interests and safety

lie in the direction of cultivating the continued output of tar fuel oils of standard character. This will not be done by users, directly fuel oil begins to be imported in larger quantity, letting their friends in need find that their services are dispensed with. Some may say it will all be reduced once again to a question of commercial values. The position is something more than that, as experiences during the present war show. If the adoption of Diesel engines is going to expand to any considerable extent, then the question of quantities and prices of the imported material will become still more important, and so will be the matter of the supply of home-produced tar oils.

In his report, Mr. Still says that there appears to be no doubt that, if such fuel oil can be supplied to a "suitable" specification in various parts of the country at a reasonable price, Diesel engine owners would soon make the necessary arrangements for its use either wholly or partially in place of the imported product. A "suitable" specification! The adjective suggests that a specification that can be so described has not yet been prepared. What about the one submitted by Mr. Charles Day, M.Sc., in the paper that he read before the Association in January last year. The terms of that specification were: (1) The tar oil must be a product of the distillation of coal tar. No product which has not undergone distillation must be present. (2) Tar oil must not contain more than 2 per cent. of solid constituents insoluble in xylol. (3) The ash content must not be greater than 0·08 per cent. (4) The water content should not be greater than 2·5 per cent. (5) The coking residue must not exceed 3 per cent. (6) The oil must be liquid at 60° Fahr. when maintained at that temperature for half an hour. (7) In case of crystals settling in the transport tank, the buyer to be allowed to drain off the liquid portion, and return the solid to the sender. Mr. Day suggested that clauses 6 and 7 might perhaps be omitted, as their inclusion in the specification would tend to raise the price. They could quite safely be omitted if means were taken to warm the oil before using. The main point, however, is: Is not this a "suitable" specification? If it is not, then why does not the Association draw up one in collaboration with the tar distillers, so that the latter may know exactly what is required?

War Loan and Gas Undertakings.

"We have done our best for war service in men and munitions; we must not stop at finance." That is a postscript to a letter from the President of the National Gas Council (Mr. H. E. Jones) appearing in our "Correspondence" columns to-day; and it crystallizes the message of the letter. "We must not stop at finance!" The war has to go on; its loss now would be an unretrievable disaster to the whole country, and not less to the gas undertakings than to other sections of our national fabric. Gas undertakings must therefore do their part in subscribing to the loan, and so contribute to the clear intention of those who have arranged its conditions, that it shall be spread over the widest possible base. The President of the National Gas Council (in his private capacity) therefore appeals to gas undertakings large and small, company or municipally owned, to do their best part—that is, to the extent advised by their bankers or other financial counsellors—in swelling the total of the loan. If they have no funds available for the purposes, then there is the ability to borrow from their bankers, who want nothing more than the security of the loan-scrip. There may be—there are sure to be—objections raised in some quarters of the industry. Mr. Jones treats these objections as they ought to be treated, remembering always that we, with our Allies, are fighting an enemy who has beaten all barbarian records for brutality in warfare.

Lighting Restrictions in France.

In "Electricity Supply Memoranda" last week, some information was given respecting the control in France of the consumption of gas and electricity, which information shows how both the gas and electricity consumers of this country have much for which to be thankful, when they compare their unrestricted condition with the restricted one of their French compeers. In this country, we have simply had appeal made to economize; a 10 p.ct. reduction of the lighting consumption was once suggested by an ill-informed Board of Trade, who, not knowing how a 10 p.ct. lighting consumption could be assessed through meters engaged on the task of registering the aggregate consumption for domestic lighting, cooking, and heating, discreetly let the notion drop. In referring last week to the French restrictions (which are compulsory through no fault of our Allies), it was stated: "As to private consumption, each individual is to be allowed normal consumption, providing it does not exceed 1 cubic metre (35¼ c.ft.) of gas and 3 hectowatt-hours (300 watt-hours) of electricity." It was not explained that the consumption of 35¼ c.ft. of gas and the 300 watt-hours of electricity referred to a day. A respected correspondent, who is always and very properly scrupulously exacting in all matters referring to data, reminds us of the omission. He tells us the new law (according to the circular of the Police Prefect of Paris, published in "Le Temps" of Dec. 21 last) clearly stipulates that the basis consumption shall not exceed 1 cubic metre of gas or 3 hectowatts of electricity *daily*. But he goes farther than this, and informs us as to the penalties that are inflicted for any infraction of the law beyond the margin allowed. He writes: "Articles Nos. 3 and 4, I think, are interesting. The former allows a margin of 10 p.ct., and the latter provides that, if this margin is exceeded, the gas or electricity supply will be cut-off for a number of days on the following scale: Excess of 11 to 40 p.ct., ten days; excess of 41 to 75 p.ct., twenty days; excess of 76 to 100 p.ct., thirty days; and over, 40 days. In such cases the supply would be closed by a seal, the unauthorized breaking of which by the consumer might involve, not only legal prosecution, but also the cutting-off of the supply for the duration of the war." The punishment appears to be more than adequate to fit the crime. Fancy for the sin of using 2 cubic metres of gas in a day, instead of 1 cubic metre, having one's gas supply cut-off for a month!

Salaries and Scientific Assistance.

The headmasters and the science masters in our public schools are very much alive to the opportunities that the present conditions afford for developing science as an indispensable element in general educational work, and selecting from the students those of keenest intellect and aptitude for the making of specialists in the different branches of industry. Attention was drawn to this in an article last week on the "Value to Industry of Science in Education." But it is clear the masters feel they are handicapped in doing the best possible by the attitude of the manufacturers themselves. The point was made by the Rev. J. R. Wynne-Edwards (of the Leeds Grammar School), in his Presidential Address last week at the annual meeting of the Incorporated Association of Headmasters. While a number of firms are quite prepared to give fair salaries to scientifically trained men who have mastered all the details of the particular needs of the firms, as a general rule they do not give encouragement by paying fair salaries—sometimes hardly a living wage—from the start. Another matter in which the manufacturers fail is that they look out for fully specialized men, while they should themselves help to provide the men by selecting good ones with a scientific education, and train them amid the practical work of their factories. This is the way to raise the intrinsic value of such men to industry. There is a responsibility (which is far from being commonly realized) resting upon manufacturers, both in respect of national and individual interests, in doing their part in giving proper encouragement to scientifically trained men, and in fitting them for their work of control and research.

American Research Work.

Reference is so often made to what has been—it is, of course, impossible to state definitely what is now being—accomplished in Germany in the way of research work, that there is at times perhaps a tendency to overlook in some degree what is being elsewhere done in the same direction. Take the United States, for example. There, we are told, the General Electric Company spend annually upwards of £100,000 on research, and employ more than 200 research scientists. The outlay of the Westinghouse Electric and Manufacturing Company, with approximately 100 investigators, is about £80,000 yearly. The Pennsylvania Railroad Company spend annually for combined routine testing and research work over £100,000; and more than 350 men are employed for the purpose. In other directions, the outlay on research work of the Illinois State University, with a permanent staff of nine scientists, is £10,000 a year; while the University of Columbia at present contemplate establishing a laboratory purely

for research, estimated to cost £130,000, and to have a very heavy endowment fund. The Mellon Institute of Industrial Research spend £30,000 per annum; the Bureau of Standards (with a staff of 400, of whom about 75 per cent. are scientifically trained), about £120,000; the Forest Products Laboratory (who possess a research staff of 90 men), £28,000. These figures, along with others referring to many different American undertakings, are taken from a paper just presented by Mr. A. P. M. Fleming to the Junior Institution of Engineers; and they will be accepted as providing a convincing reply to the question, "Does it pay?" Moreover, he was able to state that, while heretofore a great deal of industrial research work in the United States has, as shown by him, been conducted in laboratories connected with large individual firms, an Association has recently been formed for the purpose of linking-up on national lines these separate research interests, and that the efforts of the Association will no doubt be felt in matters relating to the development of export markets. It was, of course, by showing the members what is being done elsewhere, that he sought to impress upon them the need for doing more than has so far been done in this country. He regards it, for instance, as essential that, where the international market has to be considered, the research facilities of each industry should be organized for the benefit of the industry as a whole, rather than directly for its individual members, and in this way ensure the best means of combating foreign competition. First, there might be research laboratories established each serving as a scientific focus for an industry, and ultimately these laboratories might be merged into one institution which would centralize research for all industries. Further (and this is a very important part of the scheme), Mr. Fleming urges that, whatever national plans may be developed in this country, it is desirable that they should include provision for co-operation with research activities in other parts of the Empire.

Producer Gas or Coke Breeze for Boiler Firing.

The various proposals that have been put forward for applying gaseous firing to the boilers of electricity plants depend largely for success on whether the time is opportune, in relation to the existing plant, for making the change. There is one thing pretty certain, that very few electricity undertakings will care to rely on a gaseous fuel supply from a speculative non-statutory company, who just set up a low-temperature (or so-called low-temperature) coal-carbonizing plant, append to it a battery of Mond or other gas-producers (for gasifying the coke with ammonia recovery), and then meter the low-grade gas through the boundary wall to the generating station boiler-house. Most electrical engineers will want to have such gas-producing plant under their own control, unless it is being run by a statutory company. Mr. A. H. Seabrook, the General Manager of the Marylebone Electricity Department, is an engineer who, with heavy responsibility upon him, prefers absolute control; and so he has been inquiring into the question whether or not it would be commercially possible for him to gasify coke in producers, extract the ammonia, turn it into sulphate, and fire the boilers with the gas. He reports that the capital cost which would be entailed would far exceed any saving that could be effected. This is a point with which Mr. F. D. Marshall should deal. However, Mr. Seabrook has large capacity boilers; and he suggests that the next best thing to do—this being a big and paying step in the right direction of the proper utilization of coal—would be to fit two boilers with the Underfeed Company's type of travelling grate, combined with forced draught. The capacity of the two boilers would thereby be increased by 25 per cent. The boilers with the new grates would work continuously on coke breeze or similar low-class fuels, or one of the two could be fed with coke and gas obtained from a distillation plant. Apparently Mr. E. W. L. Nicol has been on Mr. Seabrook's track, and has converted him. Some three years ago, we remember Mr. Seabrook was considering the question of utilizing coke for steam-raising; but his soul was much disturbed as to the effects on the tubes of his boilers. In our issue for Feb. 24, 1914 (p. 515), we supplied our Marylebone friend with a little information that it is hoped was of some assistance to him in his subsequent investigations, which have turned out so well in favour of coke.

Sir William Ramsay, K.C.B., F.R.S., who was Professor of Chemistry at University College, London, and whose death took place in July, has left personal estate of the value of £17,896.

RETIREMENT OF MR. ANDREW DOUGALL.

READERS will be sorry to learn that, owing to ill-health, Mr. Andrew Dougall, M.Inst.C.E., is relinquishing his appointment with the Tunbridge Wells Gas Company. He has been Engineer to the Company for the long period of 36 years; and in 1901 the Directors conferred on him the additional title of General Manager. The progress of the undertaking is evidence of the good work done by Mr. Dougall; but his activities in connection with the gas profession have by no means been confined to Tunbridge Wells.

An outstanding event in his professional career was his election as first President of the united Institution in 1902-3, preceding which he had taken a very prominent part in the work of bringing about unity in the gas industry, and in that of arranging the new constitution and Articles of Association. It will be remembered that at the first meeting of the combined Institution in June, 1903, Mr. Dougall delivered his Presidential Address, in which he recognized fully the honour that had fallen upon him in being the occupant of the chair on this historic occasion. The address showed that he had great aspirations for the new Institution, and, following on the memorable address of Mr. James W. Helps regarding the expansion of the industry's technical organization, that he saw great scope for extended work under the new conditions which amalgamation had then brought into being. It should, perhaps, be mentioned that Mr. Dougall's tenancy of the presidential chair was largely due to the circumstance that he was the Senior Vice-President of the old Institute; and so his presidency on this occasion, as a matter of fact, continued without a break the line of presidential representation from the time of the old British Association. At the present time he is Hon. Auditor of the Southern District Association of Gas Engineers and Managers, a position which he has been holding in conjunction with the late Mr. James L. Chapman.

One other point should be mentioned in connection with Mr. Dougall's work outside Tunbridge Wells. Many gas undertakings are indebted to him for advice tendered in a consultative capacity; and more concerns than one in the South-Eastern part of England have to thank him for rescuing them from the disaster with which they were threatened through being the promotions of certain speculative firms of whom a good deal has been said in the past.

PERSONAL.

Captain GEORGE BRAY, of the Royal Engineers, who has been awarded the Military Cross, is a son of the late Mr. George Bray, of Leeds.

Captain FRANK RICHMOND, of the 14th Royal Warwick Regiment, who was mentioned in Sir Douglas Haig's recent despatch, is the son of the late Mr. E. W. T. Richmond.

Lance-Corporal LEONARD PILDITCH, who has been awarded the Military Medal for conspicuous bravery in the field, is a member of the Gas Distribution Department of the Birmingham Corporation.

Alderman GEORGE GUMMER, J.P., who for the past 21 years has been Chairman of the Rotherham Corporation Gas Committee, has declined an invitation to become the Liberal candidate for the Rotherham Parliamentary Division.

Second-Lieutenant R. A. BROWNING, of the 20th Battalion of the Northumberland Fusiliers (1st Tyneside Scottish), has been awarded the Military Cross. He went to the front in July last. Lieutenant Browning is the only son of Mr. E. W. Browning, late of the Gas Light and Coke Company.

Among the large numbers of the Empire's sons who have come from the far-away Colonies to aid the Mother Country, is Second-Lieutenant J. W. BROWN, R.F.C., late Manager of the Barbados Gas-Works, and previously of Port Elizabeth, South Africa. Lieut. Brown, who came home twelve months ago, and joined up on Jan. 25 last year, is proceeding to the East to-day.

An advertisement in our pages for applications for the position of Engineer and Manager of the Gorse Hill works of the Swindon United Gas Company, has been necessitated by the fact that Mr. H. C. SHEPHERD, the present Works Manager, has, owing to failing health, asked the Board to accept his resignation. At the same time, it may really be some little while before he relinquishes his position.

Among the recognitions of bravery announced in last Wednesday's "London Gazette" was the award of a bar to his Military Cross, for additional acts of conspicuous gallantry, to the late Second-Lieutenant CLIVE GRIFFIN, M.C., R.F.A. (T.F.). The announcement states that he showed great bravery and coolness as Section Commander under heavy shell fire. When seriously wounded, he refused to be attended to at the dressing-station until all the men there had been dressed. He was awarded the Military Cross in January, 1915. This gallant young Englishman, whose subsequent death from wounds we had to record in the "JOURNAL" some two months ago, was the only son of Mr. William Griffin, the General Manager and Secretary of the Folkestone Gas

Company, to whom, in his sorrow, this second tribute to a duty nobly done must be a great consolation.

Mr. CHARLES CHAMBERS has been appointed Engineer and Manager to the Harrow and Stanmore Gas Company, in succession to the late Mr. James L. Chapman, under whom the new Engineer received his training. Mr. Chambers has been at Harrow for over 26 years. He was appointed Resident Works Manager in 1897, and Assistant Manager a few years later. During the time he has been with the Company, he has seen the output grow from 30 to 361 million cubic feet per annum, and the number of consumers from 700 to about 14,000. The thorough experience he has had with the up-to-date plant for which Harrow has, having regard to the capacity of the works, long been noted, has, of course, eminently well fitted him to take up the more responsible position which has thus been conferred upon him. Mr. W. W. BALL, assistant to Mr. James Armstrong, the General Manager of the Ilfracombe Gas-Works, has obtained a similar position at the Harrow Gas-Works.

OBITUARY.

The death, on the 6th inst., is announced of Mr. WILLIAM EVANS, senior proprietor of the firm of Joseph Evans & Sons, engineers, of Wolverhampton, aged seventy. The business, which is largely devoted to the manufacture of pumping machinery and is a very old one, underwent considerable expansion under the management of the late Mr. Evans.

The death is reported as having occurred on the 1st ult., of Dr. WALTHER HEMPEL, Emeritus Professor of Chemistry at the Technical College at Dresden, who was perhaps most widely known as the author of a standard text-book on gas analysis. A short illness brought his life to a close at the age of 65. It is reported in the same number of our German contemporary that Herr WILHELM KÖNIG, the Deputy Manager of the Breslau Corporation Gas-Works, died on Nov. 19, at the age of 55 years. He held the rank of First Lieutenant in the German army. Since the year 1907, he had been a member of the Gas Industry Committee under the Government Workmen's Accident Insurance Scheme; and he had held the office of auditor on the Committee.

ELECTRICITY SUPPLY MEMORANDA.

THE "Electrical Review" and "Electrician" have been looking backward; and, in the light of what was seen by their rear glances, mixed with a little introspection, they have also looked forward. The rearward inspection discloses what excellent fellows electrical engineers are. The nation's most grateful thanks are due to them (according to the "Review"), inasmuch as they "have manfully contended against unprecedented difficulties, and have almost invariably succeeded in maintaining an adequate supply of energy." Certain other engineers have done their patriotic and official duty; and the recollection of it all is about the nearest approach to "grateful thanks" they are likely to get. However, it is the power load in munitions areas that has been the feature of the year. Large electricity supply undertakings in manufacturing districts, our contemporary states, have recorded outputs of energy breaking all records; and some small stations, which never anticipated anything in the nature of a power load, have awakened to find themselves equipped with three-phase turbo-alternators and a twenty-four hour load. The "Electrician" also refers to the remarkable industrial developments that have taken place. It, however, deplores the fact that, notwithstanding these developments, and regardless of the shortage of coal, waste is still allowed to go almost unchecked in certain important manufacturing districts; and there are still those who think that, because they have the means to purchase a ton of coal, they have the right to use it as they wish. Our contemporary had a rare good opportunity here of "slating" those electricity concerns which, through prior negligence, entered into the war period with plants demanding several pounds of coal per kilowatt-hour generated. But the editorial writer had his thoughts on the sinners outside the bounds of the electricity industry, and not those within it—electrical sinners who think they have the right to use every ton of coal they purchase extravagantly, and destroy everything in the coal for the one purpose of steam-raising.

Looking Backward and Forward.

But our contemporary gets near to the subject of this electrical waste, though not specifically mentioning it, when it refers to those who believe that relatively few generating stations would be a source of weakness to the country in time of war. It dips into the dead past to show the absurdity of the contention. "Beginning with Marathon, B.C. 490, and counting the present war as decisive, history records sixteen decisive wars. Of these, five took place before the dawn of the Christian era, and four in the eighteenth century. This leaves seven decisive wars spread over a period of 1800 years." Now what is the good of going back to B.C. 490, or to any other period, to judge the probabilities of the future? The writer has forgotten the existence of such amiable persons as the Kaiser and the Crown Prince, of Prussian ambitions, of the crowning rule of militarism, of the desire of more than one nation to be mistress of the seas, of German organization, and of modern armaments. We all hope for a decisive victory by the Allies, and for a lasting peace. But ——the conditions are not to-day even as they were two-and-a-half years ago, or at any other prior period; and where there is failure now, there will be harboured the hope that the lessons of that failure will with time assist in reversing the situation, and cause a realization of what is now being fought for from the enemy's side. We trust that the issue of the present war will be that the back will be broken of Prussian militarism and aggression; but how long can such a condition be maintained? However, that is a digression. In respect of its own interests, the electrical industry hopes that the power experiences in manufacturing areas during the war will have some potent influence upon future business. Says the "Electrical Review:" "That the war activities of the supply stations will secure for them the confidence of power users, and generate a momentum which will ensure to them a permanent and substantial development, cannot be doubted." Says the "Electrician:" "Helpful as has been the development of the power load to us during the past year in the manufacture of munitions, we maintain that even more helpful will it be found in the future." Singularly, the gas industry has been entertaining similar views. It believes, and believes sincerely, that the work that it has done in connection with the war—in the production of materials for explosives making, in the supply of furnaces large and small, and in the provision of power—will be continuously prolific of business, with the exception that the materials supplied for explosives making will be diverted to the peaceful pursuits of those industries in which dyes and colours are required, and to the supply of motor spirit and engine fuel oil. The gas industry is looking to its limits being expanded; it has good reason for doing so with confidence. And it is not greedy. It believes that most industries will get a picking out of war experiences and the resulting conditions, as well as out of a very natural desire to relieve Germany of the responsibility of a goodly part of its overseas trade.

Concentration and Influences.

The action of the Hackney Borough Council in "sending round the cap" for contributions to the costs of the preferential charges action in which they are involved with the Gas Light and Coke Company does not appear to be meeting with the ready response that was anticipated by them. Some of the local authorities who received the begging-letter have evidently taken legal opinion as to their position in the matter; and, where this has been done, the decision generally appears to be in the negative. Lowestoft, Luton, Walthamstow, Leyton, Middleton, and Stockport have declined contribution. On the other hand, Newport (Mon.) will probably contribute £10, York and Glasgow not exceeding £50 each, Hull £5, Exeter comes down with £5 5s., while, on the suggestion of the Electricity Committee, the General Purposes Committee of the Woolwich Borough Council agree that the Council should bear an "equitable proportion of the costs." Other results will probably be known in due course; but it is noticeable that Long Eaton and Ilford are not among the early subscribers. The Woolwich Council suggest that the Hackney Council and the Incorporated Municipal Electrical Association (who are taking great interest in the matter) should make representation to the Ministry of Munitions, with a view to proceedings being held in abeyance during the period of the war. What the Ministry of Munitions have to do with an alleged illegality we cannot see, and certainly we fail to understand how they can (if what is being done is illegal) advise its continuance. Meantime, while all this is going on, there is quiet confidence on the part of the Gas Light and Coke Company as to their legal position in the matter.

"Maintenance" in the Hackney Case.

A column article headed "The Superfluity of Electricity Regulations" has appeared in the "Electrical Review." The first paragraph is composed of pure nonsense; and just above it our contemporary carefully inserted the word "Communicated" so as presumably to let readers know that the absurdities are not chargeable to it. The suggestion as to "superfluity" has its answer in the paragraph that appeared in the "Memoranda" last week on the subject of electrocutions, failures, and fires. "Electricity," we are told, "suffers from too many regulations; gas supply does not." That is the first misstatement. The Legislature has taken care that gas undertakings have a good load of them; and many undertakings have found it serviceable to apply for special powers in regard to gas installations, in order to have the right of supervising and prescribing the character of piping put into houses by builders. But the writer of the article says that the fact that gas does not suffer from "too many regulations" is not because it is such an inoffensive sort of thing; and he goes on to remark that "Board of Trade inquiries into railway disasters where people are *roasted to death* owing to the use of gas for lighting purposes prove the contrary." Will the writer of the article, or the Editors of the "Review," who are responsible for its publication, supply us with chapter and verse for the statement that people have been "roasted to death" in railway accidents "owing to the use of gas for lighting purposes." In return, if desired, we will supply our contemporary with a substantial list of electrocutions due to electricity, a number of fires generated

Electrical Regulations and Relaxation.

by electricity in which people have been burnt to death—a notable one being the terrible catastrophe at Arding and Hobbs—and some mine disasters in which numerous miners have lost their lives owing to (according to the indications of the evidence) defective electrical appliances. In view of electrocutions, fires, and other uncomfortable mishaps, is it true that the "electrical industry has been foolish enough to burden itself with all the safeguarding measures and cost?" We think not. The "burden" ought to have been the protection of the industry; but it has not been. Despite all the regulations which have only one purpose—safety—there are these repeated mishaps, including many fatalities, in the course of even a single twelvemonth. And the worst of it is the electricians themselves cannot get the regulations perfect. Even in respect of those last issued by the Institution, there has been much criticism as to their defects. It does not by any means require, as the writer of the article suggests, gas to accompany an electric spark to set a house on fire; electricity has a well-demonstrated capacity for fire-raising on its own account. The writer considers the gas industry should be compelled to run iron piping covered with insulating material, and put insulating connectors between the gas-meter and the tubing. Proper insulation should be the obligation of the electricity suppliers. It is for them to keep their own destructive agent at home, and not put other people to exceptional expense to protect themselves against it. Between the registrations of the current generated and that shown on consumers' meters, there is a great gulf. It would be quite a good point that electrical regulations should be consolisated and co-ordinated; but for their relaxation, no case has certainly been made out.

The Statutory Percentage and Excess Profits.

We congratulate Mr. H. B. Renwick, the Managing-Director of the County of London Electric Supply Company (some years ago we had grounds for a little friendly criticism) and Mr. W. F. Fladgate, of the Charing Cross Electric Supply Company, upon the success of an appeal in connection with the excess profits tax. The appeal represented no less than 137 companies' undertakings; and it was for an increase in the statutory percentage before excess profits are taken into account. The Referees decided that, in the case of Suburban and Provincial companies, the statutory percentage should be increased from 6 to 7½ per cent., and, in the case of the London companies, it should be raised from 6 to 7 per cent. The companies did their level-best to debase their position; and they were successful. They work, so to speak, under a terminable lease; and the terms of compulsory purchase provided therein are extremely uncertain, and provide nothing for good will. They are also working in competition, and subject to statutory limitations, obligations, and restrictions, which, due to these and other causes, prevented in the past the formation of adequate reserves for depreciation. The pioneer work of the companies involved the successive scrapping of plant [this can only apply to the old concerns], which was another cause operating against the provision of adequate reserves. The industry was originally established for lighting purposes only; but the electric motor has been developed, and the companies have had to adapt their systems to the new and growing power demand. Some of the conditions submitted in the case for the companies cannot apply to them all; but the main thing is that the Board of Referees listened to the persuasive eloquence, and made concession to the extent mentioned.

Cooking Charges.

There have been different ruses adopted by electricians to offer a low price for current for cooking purposes. There was the rateable value system, the lump sum payable under which, some electricians said, the consumer was to delude himself was all borne by the lighting, so that, the units measured being charged out at ½d., the energy used for cooking and heating would only cost the consumer ½d, and this ½d., and no part of the lump sum, was the figure to compare with the cost by gas. Other methods of trying to make the consumer believe it was all so very cheap have been devised; but we have not heard before of the rough method adopted by the Stoke-on-Trent Town Council. They have decided, with respect to the charge for electricity for cooking, that where domestic consumers are prepared to guarantee a minimum consumption of £4 per annum, energy in excess of this amount shall be charged at ½d. per unit. All these manœuvres are a great compliment to gas sold for cooking and heating at lighting rates; but they are a gross abuse of the principles which in days gone by were said to be sacrosanct in the designing of electric tariffs.

Drawn Tungsten Wire Filaments.

Metallic filament lamps are as fruitful of litigation as the incandescent gas mantle was in former days. Mr. Justice Astbury has been engaged over a long action instituted by the British Thomson-Houston Company, Ltd., against Duram, Ltd. The latter were accused of having infringed two patents of the years 1906 and 1911, both referring to the treatment of tungsten for the manufacture of electric-lamp filaments. The first patent dealt with the apparatus for the treatment; the second with improvements in the methods of wire-drawing. The plaintiffs failed to substantiate their case to the satisfaction of his Lordship. They claimed discovery of a process for the working of tungsten, and of the fact that, when heated to 2000° C., the material undergoes remarkable molecular changes, and becomes so ductile that it can be easily drawn while hot through dies into wire. The defendants contended that the plaintiffs' claim included the working of all tungsten while hot, and was therefore a claim to a bare principle. The French chemist Moissan showed how to produce pure coherent tungsten by the use of an electric-furnace. Therefore the patent contained no new subject-matter. It was also maintained by the defendants as to the second patent that "there was nothing new in it, for the use of graphite as a lubricant had been known for a hundred years." His Lordship, in pronouncing against the legitimacy of the first patent, did not agree that a patentee could claim to prevent others from availing themselves of the common tools and routine of the metal worker for the purpose of making use of a property inherent in the metal itself—a routine which could be discovered in the ordinary way of the business of a metallurgist, and which, in fact, Moissan had published. The plaintiffs' contention was analogous to claiming a principle. Therefore his Lordship held that the first patent was bad for want of subject-matter. Regarding the second patent, he was satisfied that a complete prior user of the plaintiffs' invention for the purpose of drawing wire existed in 1905.

Our Changed Title.

Our electrical contemporaries have (with our gas contemporaries) made friendly allusion to the altered title of the "JOURNAL," which title has served for nigh upon three score years and ten. Our old friend "Meteor" invites the writer of "E.S.M." to supply his embellishments "of the reason why gas lighting has been abandoned;" for it suggests to him a "not too subtle thought." There would be just as much sense in asking a married woman, with a healthy progeny about her, why, when she married, she abandoned the title of "Miss." There has been no abandonment of "lighting" by the "JOURNAL" other than in the capital title; in the sub-title "Light" stands, as it has every right to do, in the premier position. Our former title neglected "Heat, Power, and Bye-Products;" the new one gives them recognition. During the period of the existence of the electricity industry under parliamentary conditions, the statutory gas industry has increased its gas business by 209 p.ct.—that is to say, in 1882, sales amounted to 66,613,944,000 c.ft.; and in the last complete year preceding the war, to 206,474,473,000 c.ft.—an increase of 139,860,529,000 c.ft. Despite the economy of incandescent gas-lighting, and the competition of electricity, of the total consumption approximately some 50 p.ct. is drawn from the distributing mains after daylight fails. Where is the need for the suggestion of "a not too subtle thought." "Thy wish was father, 'Meteor,' to that thought."

SCIENCE AND GAS MANUFACTURE.

A SERIES of well-considered articles entitled "What Industry Owes to Science" are appearing in the pages of the "Engineer." The fifth, which is in the current issue, is on the subject of coal and coal gas; and in it the writer describes coal-gas manufacture as one of the most striking examples of the influence of science in industry.

The gas industry, it is argued, is essentially chemical, though it was formerly entirely controlled by engineers. There was a time when gas engineers were disinclined to show much appreciation of the chemical aspects of the industry. In some works the chemists, if any were employed, were exclusively relegated to the laboratory for routine testing, without any opportunity of acquiring experience in large-scale operations. The remuneration and prospects of such chemists were so poor that few worthy of the name could be induced to remain long in their employment. In many important works, however, chemists acquired the essential knowledge of the engineering side of the industry, led the way in the introduction of improved methods, and effected developments of a far-reaching character, especially in the profitable utilization of material hitherto regarded as waste and the manufacture of new products.

The author proceeds to explain the system of gas manufacture and tar distillation, for the purpose of showing the number of processes involved, and their nature.

Testing of Refractories.—A carbon tube furnace for testing the softening points and compressive strength of refractories was described and exhibited by Messrs. E. & E. A. Griffiths at a recent meeting of the Faraday Society. The specimens are cut from the brick and ground-up into the form of short cylinders. Pressure is applied by means of springs suitably connected to carbon rods which carry the specimen under test. Two simple forms of electrode construction were referred to. In one the current is carried by two copper tubes bent into a zig-zag form, and cast into two blocks of white bearing metal. The faces of the blocks are cast to the form of the carbon tube to which they are clamped. The copper tubes also serve for water cooling. The temperature of the specimen is directly observed by means of a polarizing type of optical pyrometer. There is no difficulty in applying the pressure normally. Usually three specimens are taken from a brick, and the results only accepted when concordant. A small test-piece ensures uniform distribution of temperature. A test usually takes about 2½ hours at a 10° C. increase of temperature per minute.

GAS-WORKS AND PEACE.

By "CRICKET."

SOME gas-works have utterly failed to discover their vast importance for dictating Terms of Peace to the common enemy. Moreover, the insidious Peace Proposals of the Kaiser have, in the case of a few gas-works, scored a triumph by giving them the excuse that, upon their part, nothing need now be done, as Peace is nigh.

Let us consider the matter. Peace with such enemies can only be ensured by force. The force needed is high explosives. High explosives alone can drive the enemy back, and force Terms of Peace upon him. Gas-works and coke-oven works are the only sources of the base material for high explosives for shells. Without these high explosives, guns and shells are utterly useless in this war. Therefore, gas-works should not have to be coaxed into the recovery of crude benzol from gas. They should come forward, and offer to do so like—well, like gas-works. There never was a time when they could be of such importance to the State, and be a principal cause of winning the war, and so securing their lasting future. Action is required, not excuses.

Very many gas-works are patriotically doing their very best to win the war, and thoroughly deserve the credit they obtain—good luck to them! There are others who could do the same; but don't or won't.

Labour is scarce. It is bound to be during a great war. But how comes it that new installations are gradually being added to the list of plants in operation, and some of them at quite small works? The answer is: Nothing more than will power on the part of the management to overcome difficulties. The British will to conquer. Some have ordered plants from contractors, others have built their own; others again use their existing tar dehydration plants, still others have done nothing!

What will it disadvantage a large works if it has to spend even as much as £1000 on a complete plant, if it helps to win the war. At one small works carbonizing 1100 tons, the requisite alterations and additions cost under £30. The plant will be useful after the war largely for the dye industry, for rubber works, and also for motor spirit—all increasing necessities. There is also the cleaning industry to be supplied, and many more trades besides. Some consider the Government should assist financially. Why should the Government help when the process entails no loss? Some say there is difficulty in borrowing the necessary money. Banks readily lend to gas undertakings, and consider that the investment is sound.

Play up gas-works! Bowl the Kaiser out with shells (not "shan'ts"). What matters it if his side has scored a number of runs; and the Umpire has not noticed their extra wide bats, and the bails glued to the stumps? His last men are in. Bowl them out with extra strong deliveries. Then we will have our innings—and win. The bowling of the other side is all underhand.

EMERGENCY LEGISLATION.

REVISED to as late a date as Nov. 30 last, there has now been issued a second enlarged edition of the "Defence of the Realm Manual," edited by Mr. Alexander Pulling, C.B., Barrister-at-Law. The book, which is printed under the authority of His Majesty's Stationery Office, is divided, as before, into three parts, comprising respectively the Acts of Parliament, the Regulations made by Order in Council under the Acts, and Departmental Orders made under the Regulations, coupled with notes by the Editor on each Statute or document referred to, and a full analytical index to the whole body of the Defence of the Realm statutory law.

The advantages of having the whole matter brought together in this way will be appreciated by all who come in contact with the many regulations or orders, and their amendments. The first regulations, which were issued some three months after the war broke out, numbered 63, of which more than one-half have since been amended—in many cases extensively. In addition to this, there have been 90 entirely new regulations introduced into the code, which thus now comprises 153 regulations; and of these no less than 24 have been made since the end of last July, which was the date of the previous edition of the manual. The amendments referred to were effected by 36 Orders in Council—the latest one dated Nov. 29. All the provisions are reproduced as a single consolidated code; the alterations made and the new matter added since the date of the last edition being denoted by black lines. Among the new orders is that which gives power to the Board of Trade to take possession of any coal mines, in cases where they are of opinion that, for securing the public safety and the defence of the realm, such a course is expedient. This was the order under which the Board of Trade took possession of the South Wales coalfield—that is to say, "all coal mines in the counties of Brecon, Carmarthen, Glamorgan, Monmouth, Pembroke, and Radnor." The text of this order is given, with many others of a general character made under the regulations, in the third part of the manual. There is also the order regulating and restricting building and construction work, as well as the various ones referring to lights.

The index is, of course, one of the most important parts of such a book; and its copious character is evident from the fact that it occupies just about one-quarter of the total number of pages of which the manual consists.

THE METAL TRADES IN 1916.

IT is inevitable there should be on this occasion less to report in connection with the year's business in the metal trades than is usually the case. Much has happened, of course; but it has been of a nature to render comparison with previous years of little relative value. For the time being, the world-wide trade is disorganized; prices being influenced by many circumstances as uncontrollable as they are abnormal.

Meanwhile, the chief source of supply of iron and steel is the United States; and to America, say Messrs. Bolling and Lowe, in their annual market report, must have fallen the richest harvest that any country has ever experienced. In the matter of values, the increase has been remarkable; while as to quantity, the 1916 output of pig iron is expected to reach nearly 40 million tons. To some extent the abnormal profits must be affected by the higher wages which resulted from scarcity of labour, though it is not possible to state exactly what this inroad has amounted to. The principle of making hay while the sun shines is, the report remarks, admitted; and a further incentive thereto is to be found in the present nervous anxiety expressed in some United States papers as to the trade outlook when the war is at an end. While there is naturally diversity of opinion on some minor points, it seems there is a strong feeling in favour of the probability that large business will follow, and that Great Britain will stand a fair chance of being a formidable competitor where the United States have since hostilities broke out had things all their own way.

With regard to the present activities of this country, it is pointed out that to the majority of manufacturers their export trade is directly or indirectly the mainspring of their existence; and this, for the time being, is altogether run down. The main British export producers have become "controlled establishments," with practically only one class of customer—the combatant. The reason that export statistics do not appear to bear out a serious diminution is to be found in the larger quantities of certain materials of war absorbed by France and our other Allies, which really cannot be regarded in the light of ordinary trade results.

Considering the future, Messrs. Bolling and Lowe recognize that, though there are any number of forecasts of after-the-war conditions, they are at the present time, and in existing circumstances, of little value. There are to be taken into account the various efforts being put forth to consolidate and improve our commercial power—among them the Trade Bank, which it is thought should prove a support to the manufacturer and exporter. On the other side, there is the labour question, which is an unknown quantity. The conflict of Free Trade and Protection will again be revived; but the probability is foreseen of concessions that may produce a solution hitherto regarded as impossible. Extremes of optimism and pessimism prevail at present, they say in conclusion; but, notwithstanding all the losses incidental to the present strained condition of things, they are inclined to the view that, "aided by a community of interests, strengthened by fresh bonds of union with our various Possessions, and released from years of commercial tension and anxiety, an enormous power should be available to forge the links for a fresh and stronger claim of enduring commercial prosperity." And being available, we would add, may the power be so used.

Calorific Standard Applications and Orders Made.—The Board of Trade have received applications from the Maidenhead Gas Company and the Brecon Gas Company for the fixing of a calorific power standard of 500 B.Th.U. The following further Orders under the Act have been made by the Board: Cheltenham Gas Light and Coke Company, Gorleston and Southtown Gas Company, Lea Bridge District Gas Company, and Scarborough Gas Company.

Permits Needed to Deal in Gas-Retort Carbon.—The Minister of Munitions has ordered that no person shall, until further notice, purchase or take delivery of any gas-works retort carbon, except under, and in accordance with, the terms of a permit issued under the authority of the Minister of Munitions; and, further, that no person shall, until further notice, sell, supply, or deliver any gas-works retort carbon to any person other than the holder of such a permit. All applications for a permit in connection with this order should be addressed to the Director of Materials (reference "A.M.2.F.W.H."), at Armament Buildings, Whitehall Place, S.W.

Metal Melting by Gas Fifty Years Ago.—In these days of the extensive use of coal gas for heating purposes in almost every industry, it seems strange to read the following paragraph, which appeared in the "Ironmonger" last Saturday, under the heading of "Half-a-Century Ago:"

MELTING IRON BY COAL GAS.—M. Schoesing has succeeded, it is said, in discovering an arrangement by which an intense heat, sufficient to melt iron, can be got from ordinary gas. The principle of his contrivance is the complete combustion of proportionate amounts of gas and air in a confined space. A copper tube, carefully pierced, is the chief instrument in securing these results. M. Schoesing was able to melt a piece of iron, weighing 14 oz., in twenty minutes by his plan.

CORRECTION OF THERMOMETERS IN THE DETERMINATION OF BOILING POINTS.

WITH PARTICULAR REFERENCE TO THE EFFECT OF VARIATIONS OF BAROMETRIC PRESSURE.

By KENNETH NORTON.

IN estimating the purity of organic liquids for sale, or when testing the value of intermediate works' products, a great deal of importance must be attached to distillations, straight or fractional, and to the determination of boiling points. The accuracy of the thermometer in use is thus vital to the achievement of concordant results in the interests of buyer and seller alike. As our chemical industry extends the range of its organic products (and this it has already done to no inconsiderable degree since the outbreak of war), the importance of correct determinations becomes greater and greater.

The final criterion of purity of an organic product is often a "narrow range of distillation" if not even a "constant boiling point." Mixtures—particularly certain coal-tar products—are evaluated by estimating the volumes of distillate between stated temperatures; and it will be admitted that thermometric errors of the nature of even 0·1° C. may cause large differences in the results, and hence serious disagreement between various experimenters and observers.

The corrections to be applied to thermometers when determining boiling points are necessary to rectify:

(*a*) Changes in the physical condition of the thermometer.
(*b*) Errors of calibration.
(*c*) Incomplete immersion of the thermometer stem in the vapour of the liquid under test.
(*d*) Changes in boiling point due to alterations in the atmospheric pressure.

With regard to (*a*), it is assumed that only a good, reliable, and certificated thermometer is used; and this is warranted, of course, by the importance of the work in question. This instrument, if in constant use, will be standardized from time to time by the National Physical Laboratory or some other reliable institution; and so the effects of (*a*) and of (*b*) will be corrected. A "N.P.L." certificate will also give particulars as to the immersion; and hence clause (*c*) may be disregarded, or, if not, recourse may be made to the correction factor

$$\alpha = 0{\cdot}000143\,(T - t)N \quad \text{[Thorpe.]}$$

where N = length of column of mercury, in scale degrees, not heated by the vapour;
T = Approximate temperature of vapour;
t = Mean temperature of column of mercury not heated by vapour.

This correction is by no means negligible; and in the laboratory where many distillations in a standard apparatus are the order of the day, the use of Chart No. 1 is recommended.

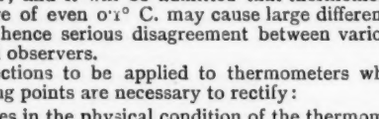


Chart No. 1.

When the position of the thermometer is fixed, as it always is fixed in standardized experiments, it is advisable to determine the values of t for that particular apparatus under the laboratory conditions, over a range of values of T.

It may be noted that differences of atmospheric temperature at the time of the experiment are of no practical significance. Thus in a certain test the following data were obtained:

T			t
50° C.	..	..	18° C.
100° ,,	..	..	21° ,,
150° ,,	..	..	26° ,,
200° ,,	..	..	31° ,,
250° ,,	..	..	41° ,,
300° ,,	..	..	51° ,,

From these figures it is a simple matter to work out the values of α for the various temperatures—noting that N = T − a constant (depending on the depth to which the thermometer is immersed). These values are shown in Chart No. 1. Each chart must be used only for work with the particular apparatus, in the same position, and subject to the same external conditions as those obtaining when the original data are determined.

In this connection a communication, by Ed. G. Wheeler, A.I.C., recently published in the "Journal of the Society of Chemical Industry" [Dec. 15, 1916] is interesting. It enables the worker to ascertain quite speedily the stem-correction for a succession of readings.

The main object of the present article is to draw attention to the effects of alterations of barometric pressure, and is concerned chiefly with the variations in the boiling points due to these differences. These effects have been worked out very thoroughly by Sydney Young, D.Sc., F.R.S., in an interesting paper, "Correction of the Boiling Point of Liquids from Observed to Normal Pressures" ["Journal of the Chemical Society," Vol. 81, p. 777].

As barometric pressure rises so also does the boiling point; and, *vice versa*, it falls as the pressure falls. Thus (quoting Young), "in order to correct a boiling point from observed to normal pressure, $\triangle t$ is to be added, where

$$\triangle t = c\,(760 - p)\,(273 + t.)"$$

Where c = a constant
p = barometric pressure observed.
t = boiling point observed.

It will be noticed from the formula that an increase of t, or a decrease of p, implies an increase of $\triangle t$, and clearly the higher the boiling point in question the greater the need for the use of the correction.

For most liquids, the value of the constant c may be taken as 0·00012, although (for reference) the following are quoted from observations by Young and by Crafts:

Chloroform, $CHCl_3$	119 × 10⁻⁶
Carbon tetra chloride, CCl_4	123 × 10⁻⁶
Methyl alcohol, CH_3OH	100 × 10⁻⁶
Ethyl alcohol, C_2H_5OH	94 × 10⁻⁶
Ethyl acetate, $CH_3COOC_2H_5$	114 × 10⁻⁶
Acetic acid, CH_3COOH	107 × 10⁻⁶
Water, H_2O	99 × 10⁻⁶
Benzene, C_6H_6	122 × 10⁻⁶
Toluene, $C_6H_5CH_3$	120 × 10⁻⁶
M-Xylene, $C_6H_4(CH_3)_2$	115 × 10⁻⁶
Naphthalene, $C_{10}H_8$	119 × 10⁻⁶
Anthracene, $C_{14}H_{10}$	108 × 10⁻⁶
Phenol, C_6H_5OH	107 × 10⁻⁶
Aniline, $C_6H_5NH_2$	112 × 10⁻⁶
Chlor benzene, C_6H_5Cl	120 × 10⁻⁶

Constants for other compounds may be deduced by inference from a consideration of their relations to similar or associated substances.

The need for using the particular value for c which corresponds to the material under test, is not of practical importance, as the differences in corrections would be in the third decimal place; and this degree of accuracy would be required only in such work as molecular weight determination, &c.

For liquids other than alcohol and water, the factor 0·00012 may be considered quite near enough for any practical purpose; and from this figure the rise in boiling point for each millimetre increase in pressure ($\triangle t$) is given in Chart No. 2. For every m.m. pressure below 760 m.m. *add* the corresponding correction to the observed reading; and for each m.m. above 760 m.m. *subtract* the correction, and so obtain the true boiling point at 760 m.m.

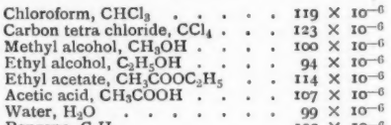


Chart No 2.

From this graph it will be seen that the correction for liquids boiling at or about 100° C. to 120° C. is 0·046° C. for each millimetre; while that for liquids of a boiling point between 200° C. and 220° C. is 0·056° C. Hence a difference of only 2 m.m. in the barometer pressure will easily account for an error of the magnitude of 0·1° C. in the observed temperature.

In order to facilitate the use of these corrections, and simultaneously to correct for the calibration errors of the instrument in use, Chart No. 3 was drawn up, and (placed in the hands of a junior chemist) proved of much use on repetition distillation work, with liquids of a boiling point between 90° and 130° C.

The method of use will be fairly clear from the arrangement of barometer readings vertically, thermometer calibration corrections obliquely, and the combined correction for the thermometer horizontally.

An example will best explain. Suppose the barometer is at 750 m.m.; the thermometer in the vapour of the boiling liquid reads 109·8° C.; the correction from the "N.P.L." certificate for this instrument at 110° C. is given as + 0·3° C. Follow along the 750 m.m. line until reaching the + 0·3 oblique line; and from

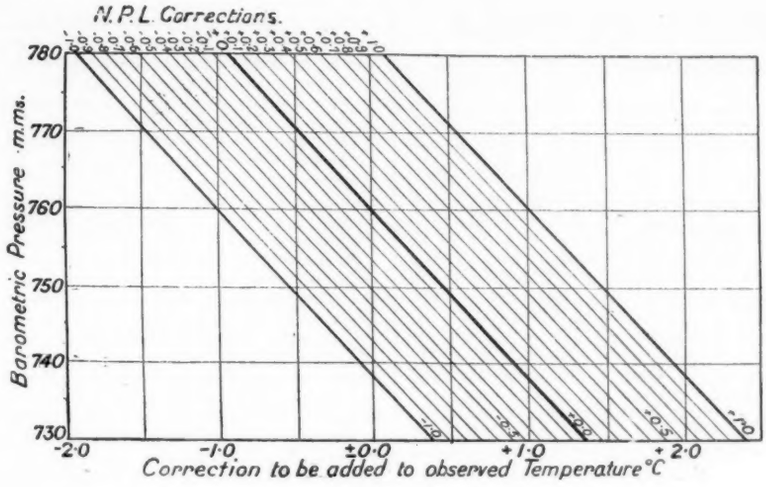


Chart No. 3.

this point trace a perpendicular to the base—finding the correction to be + 0·76. The true boiling point at 760 m.m. will, therefore, be 109·8 + 0·76 = 110·56° C.

Again, it may be necessary to stop a distillation or to read the volume of distillate at (say) 120° C. Suppose the barometer is reading 752 m.m., and that the correction for 120° C., from the "N.P.L." certificate, is − 0·7° C. The combined correction from Chart No. 3 for these data is found to be − 0·33. That is, a this point the thermometer reads 0·33 too high; and hence the figure at which to stop the distillation will be 120·33° upon the instrument used.

The chart has been found of great use in facilitating distillation work on paraffins, oils, and organic products; and when hung on the wall is a useful laboratory adjunct.

ILLINOIS COAL.

In a Bulletin recently published by the Illinois University, Mr. E. A. Holbrook describes the dry preparation of bituminous coal at the Illinois mines. While the work generally is chiefly of interest to the coal mining industry, we give a few extracts bearing on the chemistry and geology of the seams that will interest readers.

No seam of Illinois coal is free from at least small amounts of impurities. Since mines situated in widely separated districts over an area of approximately 36,800 square miles are worked in five different seams, great variations are possible locally in the nature and in the extent of the impurities in an individual seam, and in the physical characteristics of the coal itself. The most persistent impurity is the "blue band" or shale band, which in one particular case averages 1 to 2 inches in thickness, and extending with very considerable regularity over an area of at least 5000 square miles. Pyrites and shale bands are of frequent and general occurrence.

Diagrams are given of the seven seams discussed, from which it is seen that No. 1 averages 4 feet in thickness, the coal having weak cleavage, along which plates of pyrites and of calcite are developed; while sulphur bands are embedded with the coal. Directly over the coal is a shale band, 2 to 5 inches thick; while immediately below the coal there is a thin band of bone giving way to a soft fire-clay that swells badly upon exposure. No. 2 seam averages 30 inches in thickness, and consists of a top and bottom band separated by a layer of mother of coal half an inch thick together with pyrites. The roof is grey shale, or "soapstone," and the floor soft fire-clay. The same seam in another county is about 3 feet thick—the coal uniformly long-grained, hard, bright, and firm. The roof is a brittle grey shale (soap stone), separated from the coal by an approximately ¾ inch thick clay band. The floor varies from fire-clay to sandstone. In a different locality it is noted for a high percentage of fixed carbon. Seam No. 5 consists of 5 feet of massive bright coal; the roof frequently containing concretions. Another part of the same seam gives bright laminated coal top and bottom, but much softer coal in the middle. Locally in the roof there are bone and stringers of coal up to 3 feet or more above the true coal. The roof is a hard calcareous shale, and the bottom sandy fire-clay.

Average Analysis of Coal in Seams Described.

Seam Number.	Number of Samples.	Proximate Analysis, Dry Coal.				
		Volatile Matter.	Fixed Carbon.	Ash.	Sulphur.	B.Th.U.
1	11	46·40	42·41	11·19	5·55	12,643
2	3	40·32	50·20	9·48	2 45	13,091
2	33	46·34	45·21	8·45	3·45	13,101
2	15	37·46	56·24	6·30	1·42	13,765
5	54	43·32	44·28	12·40	4·15	12,384
5	27	38·06	52·25	9·69	3·13	13,165
6	76	43·52	44·67	11·81	4·59	12,406
6	58	37·45	52·96	9·59	1 68	13,025
6	31	41·94	47·14	10·92	2·98	12,764
7	18	44·01	44·52	11·47	3·37	12,807

Seam No. 6 is usually divided into benches by partings of mother coal, sulphur, or shale bands. The roof sometimes consists of a thin layer of dark drawslate containing concretions, and sometimes of cap limestone. The floor is clay shale with boulders. Where limestone forms the direct roof, the coal is stated to be harder. Other parts of the seam give tough and clean glossy coal that stands storage well. Seam No. 7 possesses a notable feature in the large lenses and bands of sulphur. In general, the lower bench of the seam is hard and dull, overlaid by a softer, cleaner coal near the centre of the seam, and again by a harder bright coal at the top.

Discussing the impurities in the different coal beds, the author divides them into three groups—inherent, sedimentary, and infiltrated. The first class describes the true or normal ash of the coal. Since coal is a product of plant remains, it must contain the original mineral matter, or ash, of such plants. Trees or plants of the present day contain 1 per cent. of ash; but since ancient plant remains have undergone great changes and losses of weight through partial decomposition before arriving at their present stage, and since the mineral matter remains without loss in the decreasing residue, the inherent ash may amount to a much larger percentage in the coal than in the original vegetable matter.

If the coal bed was formed slowly by accumulations under sheltered and shallow water conditions, and if this water was clear and without sediment, a coal would result containing only inherent ash. If, however, the water contained sediment, the slow settlement of this simultaneously with the growth of the coal-forming bed would produce a coal containing a uniform mixture of this impurity and coal. Such an impurity would increase the ash content, and would cause the coal to assume more of a rock-like character, both in appearance and physical characteristics. The sediment in such cases is usually a clay-like slime, or colloidal clay which becomes shale under heat and pressure. Such impure coal is designated "bone;" and if more than 50 per cent. is present, the coal becomes merely carbonaceous shale. Oxygen also is an inherent constituent of coal, taking the place of so much combustible material.

Bone coal also comes under the heading of sedimentary impurities and may consist of bands varying from a knife edge to considerable thickness, getting lighter in colour but heavier in weight the nearer it approaches pure shale. The unfiltrated impurities include the visible impurities which are introduced subsequent to the formation of the bed—such as pyrites and calcite. Underground circulating waters contain considerable amounts of iron, lime, and gypsum in solution, which deposit or precipitate under the reducing tendencies of the carbonaceous matter of the coal. Having started deposition around some favourable nucleus, the particles gradually enlarge with the final production of nodules or lenses. Like the interbedded shale, the pyrites is rarely pure, one lump showing 33·2 per cent. of volatile matter.

A powdery dull thin band, of paper thickness—mother of coal—forms a distinct parting between many of the layers in Illinois coal. Some analyses of the mother of coal layers from seam No. 6 showed them to contain in one case the same amount of ash as the average coal from the seam; while a different portion gave 9·75 per cent. of volatile matter, 87·47 per cent. fixed carbon, and 1·72 per cent. of ash. The latter test indicates a high grade coal of different composition to the rest of the seam.

INDUSTRIAL PROCESSES AND APPLIANCES USING GAS.

[*Continued from p. 23.*]

FOLLOWING on with the notice of the series of articles contributed to "Gas Age" (inadvertently stated at the commencement as "Gas Record") by Mr. Edward F. Davis, the use of gas blast furnaces is now so extensive as almost to completely supersede older methods, and they are now applied as a means of securing the highest possible efficiency for mechanical purposes, metallurgy, and chemistry, and designed for economical use of gas in forges, crucible furnaces, annealing, enamelling, case-hardening, and drying kilns; the heat being generated by the combustion of a properly proportioned mixture of gas and air injected under positive pressure. The chief advantages thus obtained are the perfect adjustment of the temperature to the exact requirement, which is impossible when solid or liquid fuels are used as fuel; any desired degree of heat is easily obtainable by the simple adjustment of two valves, and uniformly distributed within the given space; and either partial or complete absence of oxidation, with uniform conditions, can be assured for the performance of any heating process. The cost of the gas consumed as compared with other fuel—important in connection with the cruder operations of welding or forging—scarcely calls for consideration with reference to case-hardening, tempering, or annealing furnaces, because approximately equal quality of work cannot be produced by any other fuel.

The object of the air-blast and low-pressure gas system is to supply the whole of the air required to ensure complete combustion—about seven parts of air to one of gas—as the primary; thus avoiding the need for supplementary air openings, and securing higher efficiency than is possible with the ordinary atmospheric burner. The air is admitted under a regulated pressure of 1 to 3 lbs. per square inch, and entrains the gas. The two enter a chamber, where they are thoroughly mixed before reaching the combustion point; the correct proportioning of gas and air being indispensable to good combustion and efficiency. It is possible to get a flame of much higher velocity, to burn more gas in a given area, and to secure a momentarily higher flame temperature. If the previous mixture has been complete, the flame will be smaller in size and of higher temperature; the heat generated being more concentrated in respect to volume, and subject to lower radiation losses. The system offers the great advantage of easy regulation of temperatures ranging from 1000° to 2800° Fahr. in the shortest time, as the sudden drop caused by the introduction of cold metal is rapidly recovered, on account of the greater pressure of the mixture of gas and air. The types of furnace using air blast are:

1.—Direct heating from the flame by ring, bar, or brazing patterns of burners in a chamber usually made of fire-brick with a cast-iron outer shell, so arranged that combustion takes place in contact with the metal to be heated. It is generally used for forgings; and its efficiency depends on the arrangement of the burners, the cubic capacity of the combustion space, and the non-conducting capabilities of the refractory lining.

2.—Semi-muffle furnaces, in which the combustion takes place beneath the floor, and the products pass through the chamber in which the metal is placed. They are mainly used for annealing, hardening, and case-hardening.

3.—Muffle furnaces, in which the heating chamber is entirely sealed-off from the products of combustion—principally used when the same would have a bad effect on the work. In all muffle and oven pattern furnaces, the gas is burnt in contact with refractory material, which is thus raised to a high temperature, and radiates on the object to be heated.

4.—Bath furnaces, used exclusively for hardening and tempering; the tools, &c., being dipped in liquid contained in tanks or crucibles.

5.—Low temperature melting furnaces for metals that do not require a temperature exceeding 1000° Fahr. fitted with pots of cast iron or steel, and burners either entering the side of the furnace, or a ring below the pot.

6.—Crucible melting furnaces of upright cylindrical shape, with burners so placed that the combustible mixture enters tangentially and circles round a vessel set on a central pedestal—chiefly used in connection with materials requiring a temperature that would speedily burn-out cast iron or steel.

High-pressure gas combustion originated in England. Mr. E. W. Smith, of the Birmingham Corporation Gas Department, is regarded as a pioneer, having carried out several valuable installations and secured excellent efficiencies. The application of the system to similar purposes for which the gas and air blast are used is extending rapidly, owing to its great efficiency and simplicity. Both are intended for the production of high temperatures, and both require power-driven compressing apparatus, excepting when a general high-pressure gas supply is available. The high-pressure gas is a one-pipe system that can be adjusted by the manipulation of one valve to secure the perfect aeration necessary for complete combustion. There is no back-firing; and it is more reliable, because the gas is not subject to possible fluctuations in distributing pressure. Burners can be so constructed as to obtain the best possible combustible mixture, as the compressed gas issuing from the nipple causes a powerful suction of air, and an increased pressure of gas will inject a proportionately increased supply.

After once starting the high-pressure furnace, there is no appearance of flame in it. Combustion occurs in contact with the interior surface and the exterior of the vessel under fire; the whole becoming highly incandescent and the intervening space clear. The same is observable in large oven furnaces where the combustion space is not confined.

In the absence of a general high-pressure supply, the gas must be compressed on the premises to an extent ranging from 2 lbs. to 12 lbs. per square inch, according to the temperature required. For small installations and pressures under 5 lbs. or 6 lbs. per square inch, a rotary compressor may be used; but this type is not to be recommended for higher pressures, as, in such circumstances, the efficiency is reduced by increased slip. For pressures of 6 lbs. and upwards, a reciprocating compressor should be used. An efficient form of anti-fluctuator is indispensable as a protection for the meter; and the run of pipe from the meter to the compressor should be as long as is practicable, as the greater the distance the less will be the trouble due to fluctuating pressures at the meter. A check valve should be fixed, to protect the anti-fluctuator from any back-pressure by way of the bye-pass valve.

Surface combustion assumes that the gas and air shall be thoroughly mixed in correct proportion, with no excess of either, before issuing from the burner, so that when the ignition temperature is reached, the combustion shall be both instantaneous and complete. The appearance of a surface combustion fire in proper operation resembles that of an intensely hot bed of coal burning without flame. The gas and air pass through an efficient mixing tube to the base of the burner, and upward through a number of small tubes to the fuel bed. The refractory material is angular, like small broken stone, and is brought up to a white heat by complete combustion in the interstices. The tubes connecting the base to the hearth are air or water cooled as occasion may require. Air under pressure is always used; but it need not exceed that of the gas by more than 1 in. of water, and can easily be obtained by power-driven fans. With a 3-in. gas pressure the fan should deliver at 4 in.; but satisfactory results are obtainable with less than 2 in. and 3 in. respectively. The advantages peculiar to the system are the elimination of excessive air supply, and the superior penetrating power of the radiant heat.

The majority of the gas-blast appliances on the market are built to operate with 1 lb. to 2 lb. pressure of air, which may be generated by a fan, a positive blower, or a piston compressor. A fan, usually coupled direct to the motor, and giving a pressure of 1 oz. to 8 oz., can be used if placed close to a low-pressure appliance, and if necessarily at some distance, or supplying a number of appliances, large size galvanized pipe, 3 in. to 6 in. diameter, should be used for the blast, to cut-down resistance as much as possible. Positive blowers are the more generally used, and require care in levelling, as if not evenly set the blades may bind at one point, and an uneven pull will rapidly lead to leakage at the bearings.

The constant use of lubricating oil is very essential, as dry bearings will mean heavy running, with increased power and wear. A drip cock should be installed in the blast-pipe near the furnace, as oil may be carried through by the current, and, if allowed to go through to the burner, will become heated and gum-up the ports. Blowers should never be run at excessive speeds, and the air-pipe should enter the mixing tee from below, never from above; so that, when shut-down, any gas accidentally leaking past the valve cannot accumulate in the blast-pipe and cause an explosion when the apparatus is next lighted up. The author gives a table showing the discharge of air through orifices of $\frac{1}{8}$ in. to $1\frac{1}{2}$ in. dia., at pressures ranging from 1 oz. to 26 oz.; and he states that calculations as to the air supply may be on a basis of seven parts of air to one part of gas. A piston compressor is to be avoided if possible. The disadvantages incidental to high-pressure air are excess moisture, with possible fluctuation due to the machinery. Compression to a high degree, with subsequent reduction by an automatic valve, as a means of ensuring even pressure, is more costly than a rotary blower.

Great care should be exercised in giving advice or recommending appliances, as no special type or design is capable of universal application. Before definitely booking an order, the salesman should make sure of an efficient gas supply, and see that the service pipe is equal to the additional demand. To facilitate calculation in this direction, the author gives tables showing the flow of gas through pipes of $\frac{3}{4}$ in. to 4 in. dia., under a pressure drop of 2 in. of water, and through meters of 3-light to 300-light nominal capacity, at a pressure drop, between inlet and outlet of 3-10ths, 5-10ths, and 10-10ths. He should also see that the line of pipe from meter to appliance is sufficiently large, in view of other possible additional requirements, and make any necessary recommendations to the proper department in writing; the report being filed for future reference. The weight of the appliance in reference to the building laws governing the carrying-capacity of floors must be considered, together with the fire insurance regulations. All surrounding parts must be

carefully protected, as a conflagration caused by the appliance would have a bad effect on future business prospects.

The location is also important. If the operations depend on temperature observations, the darkest spot may be selected; and it should be entirely cut off from direct sunshine, because with variation of lighting it is difficult to make accurate visual determinations of temperature. Other operations may demand the best light available; so that the operator can readily observe the results obtained. The lighting hole of a soft metal or cyanide furnace should not be on the front, or in any position that exposes the operator to risk of injury from escaping molten metal in the not unusual event of the pot breaking; and this class of apparatus should never be fixed on an unprotected wooden floor, or without an arrangement for preventing a dangerous overflow of the contents in case of fracture. Properly arranged hoods and ventilating pipes are a necessity if the process evolves poisonous fumes; and oil-tempering furnaces should be provided with a close fitting iron cover for use in the event of accidental ignition. Connections should in all cases consist of rigid iron pipe, and all flues be attached to a proper chimney. The hood should be 8 in. or 10 in. clear above the furnace, as otherwise it may create too quick draught and waste the heat. Flues should be provided with dampers so arranged that the opening cannot be completely closed, as this would force back the products of combustion and reduce efficiency.

The salesman should be the first to start the appliance, and instruct the user fully as to the best methods of working. In lighting air-blast burners, if in the open or where an explosive mixture is not likely to be formed, first turn on the gas and ignite it, then the air, and adjust the valves as required. In ovens or other enclosed space, first turn on a small quantity of air, then place a well lighted paper or torch as near the burner orifice as possible, and slowly admit the gas until the flame (or the reflection of it) can be seen. A steady roar indicates that the gas is ignited; and when this occurs the valves are adjusted till a small blue flame issues from the vent at the top of the oven, indicating the existence in the furnace of a reducing or non-oxidizing flame, which is very essential when heat-treating steel, as preventing the metal from scaling, and when the furnace is opened in the course of working the excess gas prevents atmospheric oxidation of the metal. A simple test of the presence of a reducing atmosphere is the introduction of a slip of wood or paper, which should char without burning. With firebrick linings, the burners cannot be properly adjusted until all moisture has been dried out by gentle heat. When shutting off, turn the gas off first, but follow with the air as speedily as possible, because the play of air may injure the lining.

GAS-FIRE CONSTRUCTION.

By the RICHMOND GAS-STOVE AND METER COMPANY, LTD.

YOUR correspondent Mr. Thomas Newton, in his article in the "JOURNAL" for Dec. 12, raised some points concerning gas-fire matters arising out of a lecture recently delivered by Mr. Hartley, an abridged report of which you published.

RADIANTS.

We are in agreement with him that the standardization of radiants, at least for certain classes of fires, is overdue; and, for this reason, a few years ago we ourselves endeavoured to arrange with other makers for this to be done. Universal agreement in principle could not be obtained; and we are left at the present day with each maker pressing the claims of his own particular radiant. Concerted action should be taken by fire makers in conjunction with the gas industry; otherwise, we may eventually arrive at the following unsatisfactory state of affairs: Town "A" using only maker Z's fuel, Town "B" using only maker Y's fuel, and so on—the decision taken by those in authority in each case being determined in all probability by the extent to which the various makers' advertising campaigns have appealed to their imagination. If gas undertakings were, as a rule, in a position to carry out tests themselves, as suggested by Mr. Hartley, then a more satisfactory state of affairs would result. Gas-fire matters would probably receive sufficient thought to enable the merits of the claims advanced for the different designs of fuel to be weighed adequately; and we should probably no longer find such features so greatly extolled as the mechanical strength of the radiant prior to its use in a fire. In the lecture under discussion, it was pointed out that mechanical strength was often obtained at the expense of power to resist sudden temperature changes.

Some comparative efficiencies were cited, in which fuel manufactured at our Warrington works was compared with a well-known radiant of another maker, both in our own and the other maker's fires. The increased efficiencies with our fuel, we attribute to the difference in the actual design of the radiant and not to the material used, as we are of the opinion that the clays employed in the two cases were very similar. We have found, experimentally, that different materials may, by virtue of their physical properties, give different efficiencies; and it is not inconceivable that the chemical properties of the body employed might play a by no means small part in certain circumstances. These features do not, however, in our opinion enter into the question when comparing the fuel at present on the market.

It would be of interest to obtain an expression of opinion as to which of the two factors an engineer regards as the more important—fuel maintenance charges or fuel efficiencies. To take an example (using hypothetical data), suppose radiant "A" costs the engineer £50 per annum for renewals (labour excluded) and gives 50 p.ct. efficiency in the standard fire which he employs in the district, while fuel "B," bought at the same price per thousand, costs £75 per annum for renewals and gives 55 p.ct. efficiency, which would the engineer decide to send out with his fires, other factors being equal? The point is one which interests us; and we ourselves, believing that our radiants were not costly to maintain, decided in favour of efficiency. We are able to make a radiant possessing exceptional mechanical strength, which can, when still red-hot, be plunged into running tap-water without cracking. The radiant showed a decrease of 5 p.ct. in the efficiency of the fire; while the appearance of the latter when alight was not altogether satisfactory. For these reasons, this material has not been marketed.

With regard to the suggestion in the lecture, that in cases where an engineer had decided to adopt one of the existing patterns of radiants as his standard to be used in several fires, care should be taken that the details of the fire—such as burner drilling—suit the radiant, it was not anticipated that the purchaser would attend to these details himself, but rather that he would place the onus on the maker of the fire. Mr. Newton's article in one part appears to condemn the necessity for tests by the engineer, his staff, or consultant. If such tests are ruled-out, how is any satisfactory decision to be arrived at as to the most suitable fire or the most suitable radiant? If the decision be taken without efficiency tests, then the result may redound credit to the selling staff of the successful fire manufacturer rather than to the engineer. Admittedly, efficiency is not the only factor; but, unquestionably, it is one of the prime factors. If it be not considered, then an important incentive for manufacturers to strive to improve their appliances is removed, and we return to a state of affairs much the same as that which existed prior to the initiation of the work of the Gas Heating Research Committee at Leeds. We do not think that such a policy would receive support.

BURNERS.

At the outset, we wish to emphasize the fact that Mr. Hartley's remarks concerning aëration are intended to apply only to existing fires and radiants. The contention was that a moderate aëration gives as high efficiency results as a high aëration; in fact, that on the whole the balance of advantage is probably in favour of normal aëration. In an endeavour to define the degree of aëration simply, the phrase "the degree of aëration necessary is determined at present by that required to prevent the sooting-up of the radiants," was employed. If the degree of aëration were not sufficient to prevent sooting-up under the conditions mentioned by Mr. Newton, then it would not be capable of definition by the foregoing phrase. Sooting of the radiants should be avoided, especially in the interests of the gas engineer who, in such circumstances, receives the condemnation of the public even though the appliance be at fault. In a lecture before the London and Southern District Junior Gas Association, when discussing the same point, Mr. Hartley said: "Sooting-up can be prevented by having in the flame when the fire is hot a defined inner cone which is not broken-up by the radiant. This condition does not demand a very high aëration."

With regard to the deduction made by Mr. Newton from the results which we published. In this connection, we wish first to correct him in one particular. He says: "If the highest efficiency can be obtained from the highly aërated flame—consumption apart for the moment—why advocate a flame giving a less efficiency?" Our whole contention is that, with existing radiants, the adoption of the highly aërated flame does not enable a higher efficiency to be obtained at the optimum consumption than when a normally aërated flame is adopted.

The remaining point—suggesting the desirability of employing higher aëration, as this would enable more gas to be burnt per radiant, and thus a smaller size of fire to be employed for the work—appears to have more to support it. Let us take a specific case. Suppose that the nine-fuel "R.H.D." fire mentioned in the lecture was satisfactory for a particular room with normal aëration, then with high aëration conceivably an eight-fuel fire of the same type would do the work. To enable the consumer to obtain satisfaction during the very varied climatic conditions to which we are subjected, it might be desirable to burn as much as 36 c.ft. per hour in either fire. Assuming that the optimum gross consumption of the eight-fuel fire is as high as that of the nine-fuel fire, and that each is capable of giving the same maximum efficiency, then on the basis of the figures published one would expect the following results:

	Eight-Fuel Fire. Per Cent.		Nine-Fuel Fire. Per Cent.
36 c.ft. per hour radiant efficiency . . .	51·2	..	51·0
31½ " " " " . . .	53·1	..	53·6
27 " " " " . . .	53·0	..	52·7
22½ " " " " . . .	49·9	..	50·5
18 " " " " . . .	48·9	..	48·3
Average efficiency . . .	51·2	..	51·2

This accidental coincidence leaves the balance of the argument in favour of the eight-fuel fire on the ground of first cost, provided our original assumption holds and that the more highly aërated flame is adjusted to consume only ½ c.ft. per hour per radiant more than the other. If the duty to be extracted from the smaller size of fire be relatively greater still, and a seven-fuel fire be called upon to do the work of the nine-radiant normally aërated flame (and if we are not mistaken this has been advocated by an exponent of high aëration), the determining factor might still be the radiant efficiency of the two sizes of fire at their optimum consumption. In the case of the seven and nine fuel highly aërated fires there would probably be a difference of 5 units on 50—*i.e.*, 10 p.ct. in favour of the fire with the larger number of radiants.

Where we differ essentially from certain high aëration exponents is on the question of the radiant efficiency obtainable from a given fire. With existing fires and radiants (and we emphasize these limitations to our remarks), the substitution of the highly aërated flame for the sluggish flame does not ensure an increase in radiant efficiency.

In conclusion, we wish to express our appreciation of Mr. Newton's reasoned article, the delay in replying to which has been due to the pressure of other work. We feel that the points he has raised should be thrashed out in the interests of the industry. We are especially glad to notice his advocacy of the standard radiant. Perhaps the Gas-Heating Research Committee, when they resume their labours, will assist in this direction by an examination of the merits of the various designs of fuel in common use. They can at least be sure that their report would lead to an energetic although, we hope, not to an acrimonious discussion.

THE USE OF GAS AND ITS INFLUENCE ON DOMESTIC ARCHITECTURE.

By THOS. NEWTON.

THE use of gas for all conceivable purposes in the household will, sooner or later, inevitably exert a beneficial influence on the general internal structural arrangements of all residences which lie within the area of a town's gas supply. Hitherto, architects and builders have somewhat ignored, or at any rate they have not greatly concerned themselves with, the claims of gas apart from lighting considerations; and even in the latter respect, judging from the meagre sizes of pipe specified, there is ample room for much improvement. Incidentally, it may be mentioned that when the disadvantages of specifying and planning inadequate lighting supplies are fully realized, this pernicious practice will surely and immediately cease; for nothing is so exasperating to the owner or tenant of a new residence as to suffer the inconvenience and annoyance of having new floor boards taken up, new walls cut, &c., for the sake of having a larger-sized pipe laid to supply a few additional lights that may eventually be required, and which ought to have been provided for by planning the original supplies of ample dimensions. But it is not so much in connection with lighting supplies as in other directions that the use of gas is destined to exert an influence on what may be termed domestic or residential architecture.

TRIUMPH OF THE GAS-COOKER.

The preference given to gas-cookers by all classes of the community is thoroughly justified on the grounds of efficiency, economy, and convenience; and this preference is already causing many of the wasteful coal-ranges which formerly held undisputed sway to fall into disuse. The claims of the modern gas-cooker are irresistible. The ubiquitous gas-cooker is everywhere effectively ousting its wasteful, and almost obsolete, rival. Indeed, the transition from the ancient to the modern has become so pronounced in some localities as to render the crude coal-range entirely superfluous. It is thus rendered more or less an encumbrance, which is only tolerated because it cannot be readily removed. The modern tendency is unmistakable; and it is undoubtedly in the direction of the gas-cooker superseding all others. Hence, this being the case, no useful purpose is served by indiscriminately planning and fixing coal-ranges where they will neither be used nor required.

STRUCTURAL MODIFICATIONS TO MEET MODERN NEEDS.

The initial expense of installing a coal-range is considerable, and when, as frequently happens, the range is immediately discarded in favour of a gas-cooker, the initial expense becomes positive waste. Nor is the waste confined merely to this aspect of the question, inasmuch as valuable space is occupied that might be made to serve a more useful purpose. The installation of a coal-range also involves the building of a more or less massive chimney breast; and here, again, we encounter materials, labour, and space all wastefully employed in the presence of a gas-cooker. A 3-inch diameter flue pipe is generally deemed to be sufficient to conduct the products of combustion from the oven of an ordinary gas-cooker into the flue; and in the event of a hood being required, a cross-sectional flue area of from 40 to 50 sq. in. would amply suffice. In this connection, it should be remembered that the cross-sectional area under consideration will not be reduced by accumulations of soot, such as occur in a coal-range flue. Abnormally large-sized flues on this account are therefore entirely unnecessary. It will readily be understood that the substitution of a smaller dimensioned flue, as indicated, in place of the cumbersome chimney breast, would result not only in a welcome addition of floor area, but also in an increase of the cubical contents of the kitchen.

The installation of a gas-cooker eliminates the dust and dirt (inseparable from a coal-range) from all cooking operations; and this conduces to cleaner surroundings. Tiles can thus be used to great advantage in the immediate vicinity of the cooker. The cooker, for instance, could stand on a tiled hearth, and, if desirable, it could be accommodated in a tiled recess—provision, of course, being made for the effective use of the hot-plate and plate rack. Alternately, the cooker could stand on a tiled hearth, in front of a tiled slab, through which the products of combustion could be conducted into a flue situated at the back. The structural modification could be designed to include a canopy; and this might be fixed at a convenient height above the cooker, in order that the odours of cooking and the products of combustion from the hot-plate burners might first be collected, and then conducted into the flue.

As regards domestic hot-water systems, many of these, of course, are dependent on range back-boilers. This arrangement is both wasteful and inconvenient, inasmuch as a comparatively large amount of firing-up is necessary before even a small quantity of hot water is available. This aspect of the question, however, has already been dealt with [*vide* "JOURNAL," Vol. CXXXIV., p. 219]. One great advantage of installing a gas water-heater is that it need not be tied to the cooking apparatus. It could, for instance, be fixed in the basement, or the kitchen, or even in the bathroom. Whatever its situation, the chief consideration from an architectural point of view is the provision of a flue of approximately 20 sq. in. cross-sectional area. Where the water-heater is preferred alongside, or in the immediate vicinity of, the cooker, the cooker flue would need to be increased by this amount. It will thus be seen that by modifying the structural arrangements on the basis of an adaptation of means to a given end, a flue having a cross-sectional area in the neighbourhood of 70 sq. in. would dispose of the products of combustion of a substantial water-heater and a gas-cooker, besides removing the odours of cooking.

A splendid opportunity certainly presents itself to those architects who, in sympathy with modern requirements, will produce designs embodying some such suggestions as those that are foreshadowed above. Several combinations have already been evolved in all of which a gas-cooker, a water-heater, and a gas-fire are arranged to perform their various functions; and this is a step in the right direction. But even so, the existing architectural features of the chimney breast impose certain limitations, in the absence of which a more harmonious design could be introduced. This is precisely where the architectural touch is required; and it is fairly safe to predict that it will be forthcoming in the near future.

GAS-FIRES *versus* COAL-GRATES.

The number of appreciative consumers who prefer gas-fires to coal-grates is now increasing very rapidly. A variety of circumstances have combined to bring about this most satisfactory state of affairs, to which the leading gas-fire manufacturers have contributed in no small measure by their enterprise and initiative. The modern gas-fire is now recognized by a growing section of the public to be both highly-efficient and convenient; and its many advantages only need to be mentioned to the other section in order that they may be thoroughly appreciated. To have an unlimited amount of economical heat on tap—always available and under complete control—in these strenuous days is a veritable boon to those who desire comfort and accommodation without the dust, dirt, and labour inseparable from crude solid fuel. The shortage of domestic labour, too, has been responsible for many conversions from solid to gaseous fuel; and this notable fact is an eloquent commentary upon the disadvantages of the former and the advantages of the latter.

The results of a little personal and familiar acquaintance with some of the problems of domestic economy have proved a revelation to those most intimately concerned. It is therefore not at all surprising that relief should be sought for at the earliest opportunity—particularly when it lies so close at hand, and in such an attractive form as a gas-fire. This is one of the evolutionary factors which is making gas-fires so popular; and its influence on domestic architecture will become more and more pronounced in the near future. When once the full significance of all that is involved is fully realized, it will no longer be considered necessary to specify and fix elaborate and expensive coal-grates, which will certainly be discarded, either immediately or ultimately, in favour of gas-fires.

What has already been stated in connection with the chimney breast of a coal-range, applies with equal force to that of a coal-grate. With a flue having a cross-sectional area of about 40 sq. in. (which would usually be ample to accommodate almost any type of gas-fire), the present chimney breast could be reduced to one-half its width and depth—and this without adversely affecting the provision for an adequate flue in, and for, the room above. The advantages are obvious. The structural modification involved would enable the architect to demonstrate

the possibilities of a suitable gas-fire fixed in an appropriate tiled recess, or, alternatively, with a tastefully-designed tiled surround. A more ambitious scheme would be one having a series of artistic tiled-panels with a moulded bordering surrounding the whole. The possibilities are immense, in the hands of an architect who desired to take full advantage of the opportunity thus offered.

It should not be lost sight of for a moment that tiled recesses and surrounds are at present in every-day use in connection with gas-fires, and are giving every satisfaction. The objection here offered is that by a slavish adherence to the orthodox structural arrangements round about the fire-places of our dwellings, certain limitations are imposed on the employment of gas-fires and their artistic surroundings—against a modern tendency that ought to be cultivated by the gas industry to the fullest extent. The effort to restrict occupiers to the use of a crude fuel by planning and designing residences primarily with this end in view is, to say the least, somewhat unreasonable—particularly when it is remembered that many have already shown, and more are now showing, their decided preference for the cleaner, more convenient, and labour-saving gaseous fuel. The use of gas will not only ultimately exert a beneficial influence on internal domestic architecture, but it will also exert a similar influence externally. In the light of our present knowledge, compelling circumstances will probably bring about this consummation at no far distant date.

AN ACCURATE METHOD OF DETERMINING THE SPECIFIC GRAVITY OF GASES.

The United States Bureau of Standards, finding that there was a need for an accurate method of determining the specific gravity of gases, and that the effusion type of apparatus as generally used was not reliable, have investigated available methods, and devised an appliance that will shortly be described in an official paper, a condensed form of which, by permission of the Director of the Bureau of Standards, has been communicated to the "Gas Record" by Mr. J. D. Edwards.

It is based on the fact that the buoyant force exerted on a body suspended in a gas is proportional to the density, and therefore to the pressure. If the buoyant force is made the same, when suspended successively in two gases, the density of the two gases will be the same at the respective pressures, or the density at normal pressure will be in inverse ratio to the pressure.

Fig. 1 shows a simple form for laboratory use, constructed almost entirely of glass. The outer case is made of a piece of tubing about 40 m.m. in diameter, closed at one end and fitted

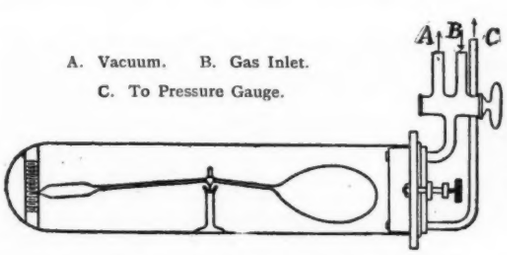


Fig. 1.—Simple Glass-Case Balance.

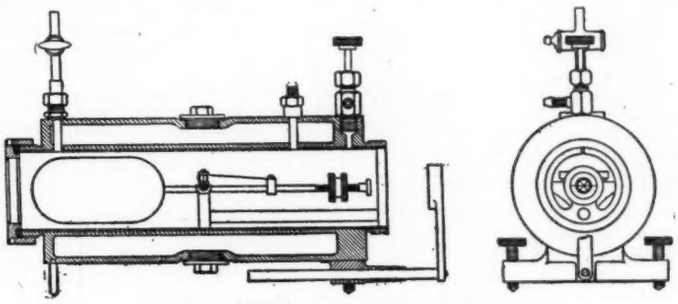


Fig. 2.—Details of Balance Construction.

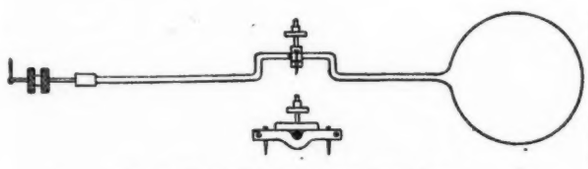


Fig. 3.—Balance Beam—Glass-Metal Form.

with a rubber stopper at the other in such manner as to be perfectly gas-tight under a pressure of one atmosphere. Two tubes pass through the stopper—one fitted with a two-way cock (A to connect with the vacuum pump and B with the gas supply), and the other C joined up to a mercury filled U-gauge. The beam consists of a piece of rod 1·5 to 2 m.m. in diameter, bent sufficiently to bring the centre of gravity below the point of support, having a light glass globe sealed on to one end, a solid glass counterpoise at the other, and a short piece of rod sealed vertically to the centre. The knife-edge consists of two very sharp needle points firmly cemented to the beam, resting on a semi-cylindrical glass trough, made by grinding-down with emery a short piece of tube on a flat plate, and cemented to a vertical pillar which is attached by the same means to the case. The beam must be carefully adjusted to approximately balance in air, and possess the requisite sensibility, as shown by a long period of swing. A change of pressure equivalent to a few tenths of a millimetre of mercury should produce a measurable change on the point of equilibrium, the position of which is read on a small scale, or by reference to the cross-hair of a reading telescope focussed on it.

A more satisfactory, but more costly, instrument, suitable either for field or laboratory use, is shown in fig. 2. The balance case and water-jacket can be made-up of brass tubing or cast in one piece, and the casting may be lined with thin metal tube to eliminate any possible leakage. Aluminium may be used in place of brass if lightness is a consideration. The ends are closed with screw caps fitted with soft leather washers, and having glass windows cemented in. A glass stop cock shown on the left provides means for admitting gas or air, and at the other end is a needle valve used for the delicate adjustment of pressure, also a connection for a small copper tube leading to the gauge. Preferably all the connections should be attached to the end away from the globe.

The globe and beam may be entirely of metal to facilitate their use for field work, though the weight is diminished and the sensibility increased by the use of a glass as shown in fig. 3, in which a light metal rod or tube cemented to the end carries two lock nuts that serve as a counterpoise, a slender pointer turned up at the end to permit observation of the tip against a light background, and a celluloid nut carrying fine cross lines. The cross arm is made in two pieces, and clamped to the beam. In the all-metal form, the globe is of spun brass attached to a bronze tube beam, and the carrier is connected by a rod to a split ring fitting closely into the end of the case (see fig. 2). A glass window fitted into the ring carries a cross line, which, in conjunction with the lines on the celluloid nut, serves as a reference when balancing the beam.

The accessory apparatus comprises a mercury U pressure gauge, a vacuum pump, and a drying tube for the gases, as it is obvious that only perfectly dry air or gas can be admitted into the case. For field use, the appliance can be mounted on a folding tripod stand. Full operating instructions are given, also the results of several experiments showing figures that agree within a margin of 0·2 or 0·3 p.ct. Among the advantages claimed are lightness, portability, durability, accuracy, and no necessity for preliminary calibrations.

NATURAL GAS AS BOILER FUEL.

An account was given by Herr R. Schröder, of Hamburg, at the annual meeting at Altona of the Association of Gas and Water Engineers of Lower Saxony, of the extensive use which is now being made of natural gas as boiler fuel at the Rothenburgsort Station of the Hamburg Corporation water undertaking. This account contains a number of features of interest, which have been abstracted from the reprint of it in the "Journal für Gasbeleuchtung" of the 2nd ult.

The natural gas, from which the supply is derived, was discovered on Nov. 3, 1910, when boring for water at Neuengamme, a village about 2¼ miles south-west of Bergedorf, which is about 11 miles from Hamburg. The bore-hole had reached a depth of about 815 ft. when the gas was tapped, and gushed out with great force. The outrushing gas became ignited 15 hours later from some unknown cause, and burnt for several weeks, giving three columns of flame of an extreme height of 60 ft. The gas was extinguished and the bore-hole capped on Dec. 2, 1910, after a loss of gas estimated at about 530 million cubic feet. Analyses of the gas by the Drs. Bunte show that in August, 1913, it contained 95·3 p.ct., and in July, 1916, 97 p.ct. of methane, and had a gross calorific value of about 980 B.Th.U. per cubic foot at 60° Fahr., 30 in., and saturated. One volume of the gas requires 1·96 vols. of oxygen for its combustion.

It having been ascertained that about 15 p.ct. of this gas could be added to the Hamburg town supply without necessitating any change in the gas-burners in use, while effecting an appreciable increase in the calorific value of the gas, it was decided in 1912 to lay a main from the boring at Neuengamme

to the Tiefstack Station of the Hamburg gas undertaking, and a subsidiary main from Tiefstack to the Rothenburgsort pumping-station. The Neuengamme-Tiefstack main is 9·55 miles in length and 10 in. in diameter; the Tiefstack-Rothenburgsort main 1·1 mile in length and 6 in. in diameter narrowing to 4 in. near the latter place. Since the completion of these mains and the pressure regulators and other accessory plant in August, 1913, natural gas has been mixed with the coal gas as supplied to Hamburg, and has been used for boiler fuel at the Rothenburgsort pumping station. The pressure at the Neuengamme source is governed down to 3·4 atmospheres; it is reduced at Tiefstack at the inlet of the main to Rothenburgsort to 160 in. to 180 in. of water, falling to about 120 in. to 160 in. at the outlet at the latter place. In the supply pipes to the boilers the gas pressure is from 4 in. to 16 in. of water.

The best method of burning the gas was determined by trials of different forms of burners in an old Lancashire boiler without superheater. The burner finally adopted has the gas nipple with about ⅛ in. hole, set about 5 in. in front of the coned mouthpiece of a pipe about 4¼ in. in diameter; the total length of mouthpiece and pipe being about 19½ in. The mouthpiece and pipe are inside a rather longer counterpart, of rather more than 1¼ in. greater diameter; the annular space serving to carry a supply of secondary air well in front of the mouth of the pipe. The chief air supply is drawn in at the coned mouthpiece by the injecting action of the gas. The burners complete with air supply pipes, of which two are fitted to each furnace, are pushed into openings in a plate which covers the furnace door opening, and are inclined downwards at an angle of about 5° to the horizontal. The grate is covered by a bed of clinker, broken to the size of a nut, which hinders the inflow of air and protects the fire-bars from impinging flame. The whole has been arranged so that the change from gas to coal firing can be made rapidly if occasion arises, as was the case in June, 1915, when, owing to the fracture of a bend in the main at the Tiefstack works, the supply of gas was suddenly cut off without previous warning. The transition to coal firing was then completed in an hour on ten boilers supplying steam to eight pumping engines. In all 24 modern boilers with superheaters have been equipped with gas-burners. In ordinary working, 14 boilers supply the steam required by the complete installation of eleven pumping engines. The gas supply to each boiler is regulated, according to the demand for steam, by using one or both burners in each furnace, and by varying the gas pressure while at the same time altering the air supply to the burner, for which simple provision is made.

Combustion is considered satisfactory when the flue gases contain on the average not less than 7 p.ct. of carbonic acid. The burners were constructed on the works from steel plate 0·04 in. thick by oxy-acetylene welding. The gas supplied is measured only by a meter as it leaves the Tiefstack works. During the years 1914 and 1915, the boilers were heated with only trifling interruptions solely by gas, of which the volume consumed measured at normal pressure (760 m.m.) in the two years was 455,480,000 c.f. The boilers heated by it supplied steam for pumping 21,528,615,000 galls. of water to an average head of 176·7 ft. The average consumption of gas per h.p.h. was 25 c.ft., as compared with an average consumption of coal (in 1911 and 1912) of 1·65 lbs. These figures are approximately in the ratio of the calorific values of the gas (928 B.Th.U. net) and coal (13,320 B.Th.U. per lb.). The use of natural gas as boiler fuel since August, 1913, to the end of August, 1916, has saved the consumption of over 22,000 tons of coal at the Rothenburgsort pumping station.

NITRATION OF TOLUENE.

A technical paper issued by the Bureau of Mines (U.S.A.) gives the results of experiments conducted in the explosives laboratory, on the preparation of trinitrotoluene from toluene obtained in the manufacture of carburetted water gas, and includes a brief account of the theory concerned in these operations, and a review of the technical methods hitherto adopted. The experiments comprised a comparison of several different procedures for arriving at the desired result, investigation of the effect of varying proportions and concentrations of the nitrating acids, and the influence of the temperature of nitration on the yield and quality of the product. On the basis of the information thus obtained, the author outlines a method that is believed to secure the best results.

The first step is the preparation of mononitro-toluene, and the second is the further nitration of this crude product into trinitrotoluene, which is believed to be performed in two stages, but without a separation of the dinitro-toluene that is formed as an intermediate product. The specific gravity of the sulphuric acid used is 1·84, that of the nitric acid in the first step 1·42, and in the subsequent operations 1·5. The acids employed for the preparation of the mononitro-toluene are a mixture of two parts of sulphuric acid and one of nitric acid by weight; the quantity of the last-named ingredient being 50 per cent. in excess of that required by theory to convert all the toluene into the mono compound. The maximum temperature of nitration is 30° C. The mononitro-toluene is next dissolved in equal parts of sulphuric and nitric acids—the nitric content being again 50 per cent. in excess of the theoretical requirement; and in this case the maximum temperature of nitration should not exceed 100° C. The acids are then concentrated by the addition of 15 per cent. oleum, of equal weight to that of the mixed acid that is to be used in the final treatment. This consists of equal weights of nitric acid and 15 per cent. of oleum; the acid being double the quantity required according to theory to convert the intermediate product calculated as dinitrotoluene into trinitrotoluene, and the temperature of nitration must not exceed 117° C.

This method yielded a water-washed product of about 75 per cent. of the quantity indicated by theory, which melted at from 78° to 80° C. and 8½ per cent. that melted below 75° C. from the spent acid. When washed with an alcohol-benzol mixture, the yield was approximately 69 per cent. melting at 89° to 91° C. and 7½ per cent. melting at 78° to 81° C.

IMPORTANCE OF MAINTAINING A GAS SUPPLY OF UNIFORM QUALITY.

In a communication to the "Gas Age," Mr. A. C. Howard, Gas Engineer to the United Gas and Electric Corporation of New York, emphasizes the importance of a gas supply that is uniform or nearly so, in respect to illuminating and heating value, specific gravity, and freedom from naphthalene—illustrating the point by references to troubles that have arisen in actual practice, and remedies that were successfully adopted.

Incidentally the writer disposes of the idea that the introduction of a carburetted water-gas plant will stave off the necessity for an increase of storage, and infers that, where mixed gases are supplied, the storage must be greater rather than less. Small changes, or slackness of supervision, may impair the uniformity, even when standard plant operated by standard methods is employed; or a wide departure can be made from standard methods, without trouble in the district, provided the outgoing gas is competently watched and tested. If only one kind of gas is sent out, there is little chance of lack of uniformity, as most of the trouble arises from variable proportions of mixtures. Seeing that the combustion air requirements vary with the heating value, and the air apertures on the burners are practically fixed (as the consumer rarely troubles to regulate them, even if he knows how), the chances are that a poorer gas will get too much air, and a richer gas too little; and since the passage of gas through orifices varies inversely as the square root of the density, the same applies to fluctuations in density, even if such are not attended by changes in heating value. So that if a works changes from one kind of gas to another of similar heating value, it is still possible that trouble may be experienced in the district.

In one case, a change from "half-and-half" to all carburetted water gas necessitated the readjustment of all the atmospheric burners in the district. Another gas company, also supplying "half-and-half," had much trouble with the mantle lights, due to the fact that, for economic reasons, the water gas was made during the day only, on a single shift, and the bulk passed direct to the commercial holder to which the coal gas was admitted at a uniform rate. The holder capacity being small, the hourly variation in quality was sufficient to depreciate the service. The remedy consisted of arranging to supply the water gas at a uniform rate from the relief holder. In a third instance of "half-and-half" supply, the putting into use of additional coal-gas benches led to a fluctuation of the specific gravity between ·45 and ·65, and great complaint from the consumers. On account of small storage, it was the custom to shut-down the water-gas set during the night. The difficulty was met by reducing the proportion of coal gas and equalizing the supply of water gas as far as the relief holder would permit. This shows the impossibility of running a mixed plant with large generating and small storage without trouble in the district; also that when coal or oven gas is made in one location and water gas in another, the gases must be mixed in holders at central points before distribution.

A company distributing 750 million c.ft. of water gas decided to put down a 300 million coal-gas plant, and to run the water-gas set for twelve hours a day only. They had one two-million and two half-million holders, and arranged to use the latter for the storage of water gas, to be sent forward into the large holder in fixed proportion to the make of coal gas. The result was entirely satisfactory. At another works, the plant was operated under a dual standard, and forced to carry an unnecessarily high heating value in order to maintain the required candle power. Benzol cost 10 c. per gallon, and gas oil 5·5 c.; and by reducing the proportion used in the water-gas house, and vaporizing benzol into the mixed gas, they were able to economize the oil consumption one gallon per 1000 c.ft. by the use of 0·14 gallon, thus securing a net saving of 1·35 c. per 1000 c.ft. made.

A company sending out mixed gas found that a mixture of scrubbed oil gas generated in the retort-house with blue water

gas would be more economical. The change was gradually effected; an excess of coal-gas plant enabling the oil gas to be in working order before the use of coal was discontinued, and the first intention was to mix in the relief holder to ensure even quality. Occasion arising for cutting out the relief holder for a time, the two gases met and mingled at the inlet of the commercial holder. The oil gas was 1300 B.Th.U., and the blue gas 300 B.Th.U.; and the object was to get a 600 B.Th.U. mixture. The system was found very flexible; and with the aid of periodical tests the heating value could be accurately adjusted by slight variations in the proportion of oil gas. No complaint was received from the district, and the mixing in the relief holder was abandoned as unnecessary.

After running in this manner for a time, the candle power showed a decided drop. Probably at the start the mains contained condensed oils, which were gradually absorbed and used up; and the difficulty was met by the use of a small quantity of oil in the water-gas set. Naphthalene also appeared in some of the services; and this was traced to the water gas. The heats were being kept too high; and a reduction proved a perfect cure. Possibly the gas also picked up old deposits in the mains and carried them forward. The specific gravity of the new mixture was ·506—little different from that of the previous supply.

DRESSER COUPLINGS FOR CAST-IRON PIPES.

Writing to the "American Gas Light Journal," Messrs. R. D. Wood & Co., of Philadelphia, speak highly of the superiority of the Dresser form of coupling, as compared with the usual lead joint, after long use and experience with both, and incidentally in favour of cast iron, in preference to wrought iron or steel pipes, even for pressures of 40 lbs. per sq. in. As evidence of the indestructibility of cast-iron pipes, they mention that in 1907 the City of Rochester had occasion to take up a run of 4 in. that was laid in 1872, and had seen 35 years' continuous service; but after cleaning the pipes were sold at a profit on the original cost. They regard the bell-and-spigot lead joint as largely responsible for the preference that has been extended to material other than cast iron.

They have used Dresser couplings and cast-iron pipes since 1910 on high-pressure gas-mains carrying 15 lbs. to 40 lbs., and are still looking for the first defective joint. They have also laid wrought-iron pipes with screwed joints, using a Dresser coupling at intervals of 250 ft. to serve as an expansion joint, with satisfactory results except as regards the material of which the pipes are composed. The life of these will compare very unfavourably with cast iron, especially in soils containing limestone, cinders, or other objectionable material, as cast iron will resist the action of such constituents for a lifetime. The ends of the pipes they use are quite plain and free from anything in the way of a bell or spigot, and the only leaded joints are immediately on each side of valves which carry bell ends; and these are protected by Dresser safety couplings, which prevent the lead from shifting. As to the comparative cost, when laying 4 in. the lead joints average $0·86 each, and the Dresser coupling $1·26. With 6 in. pipes, the figures respectively are $1·04 and $1·90, and with 8 in., $1·74 and $2·50. The substitution of the Dresser for the lead joint only increases the total outlay to the extent of 1 to 1½ p.ct., and joint leakage is entirely eliminated.

ARTIFICIAL FIBRE MANTLES.

Dealing, in the "American Gas Light Journal," with the development of the artificial fibre mantle, Mr. R. Ffrench Pierce says the type of fibre required has been obtained by dissolving cotton in nitric and sulphuric acids, breaking-down the cellular structure; the cellulose being precipitated out of the solution by ammonia as a syrupy mass, devoid of structure or form. By squirting this cellulose through a die, and hardening the tiny filament so produced, a continuous solid rod of pure cellulose is obtained, from which a mantle may be knitted and sewed, saturated with thorium and cerium salts, and the cellulose burned out, precisely as with a cotton mantle. Numerous processes for making this artificial fibre are available; but many produce a sort of fibre that is unsuitable for mantle manufacture. After the fibre is obtained, the making into a satisfactory mantle involves many difficulties not met with in the manufacture of cotton mantles, so that the production of the fibre itself is really the least important part of the development.

The finished artificial fibre mantle as furnished to-day represents more labour, investigation, technical skill, and elaboration and refinement of manufacturing process than any other substance used in the manufacture of lighting apparatus. It is not too much to say that it has been many times more difficult than the development of the carbon and tungsten filament electric lamps put together. Yet this fact is unknown to the general public, and is, perhaps, only appreciated by those who have actually done the work. That recent years have witnessed a continuous and considerable improvement in the strength and efficiency of gas-mantles, is pretty generally understood. Every user whose experience extends over a decade must have noted the greater illuminating power of the product of the last four or five years. This appreciation is, however, usually rather vague, and seldom based upon definite knowledge; and it is more than likely that the achievements of recent years are very much underestimated. For all practical purposes, the candle power of the best mantles is undiminished over a period of 5000 hours.

An immense advantage of the artificial fibre in mantle manufacture is the retention of physical strength throughout life. Mantles made upon vegetable fibres become greatly weakened after burning a few hundred hours; and from a practical standpoint this is a much more frequent source of depreciation than the diminishing candle power. Most mantles based upon natural fibres go out of service from breakage, due to lessened mechanical strength, long before the candle power has fallen to such a point as to render them useless. Mantles made of artificial fibre, on the other hand, lose their mechanical strength very slowly. After burning several hundred hours, the fibres are still sufficiently strong to support a weight of an ounce; whereas natural fibre mantles after the same period can support little more than their own weight. The introduction of the artificial fibre into mantle making has resulted in the elimination of one of the most serious handicaps under which gas lighting has laboured in the past.

REGISTER OF PATENTS.

Gas-Lamps.

FULLER, W. J. H., of Toronto, Canada.

No. 14,155; Oct. 6, 1915.

This invention in gas-lamps consists essentially in the arrangement of the parts whereby the gas is heated in its passage from the receiving chamber to the mixing and distributing chamber and in the means for lighting the several burners of the lamp. The objects aimed at are to facilitate combustion by heating the gas, to economize in the consumption of gas, to produce a lamp the parts of which are so arranged as not to cast a shadow on the globe, and to facilitate the lighting of the lamps.

The lamp is of the type in which the mixing and distributing chamber is centrally disposed and surrounded by the several burner-heads in close proximity to the zone of intense heat. The mixing chamber is connected to the gas-receiving chamber above by a pipe passing externally to both chambers and through the heated zone created by the incandescent mantles. The lower end of the pipe, below the burner-heads, is furnished with a valve for regulating the supply of gas to the mixing and distributing chamber, and thereby to the several mantles. This mixing chamber is of inverted cup shape provided with a screen lining. A tubular downward extension attached to the chamber is furnished with valve-controlled air-holes, and a ratchet controlled valve for regulating the ingress of gas to the extension and mixing chamber. The receiving chamber, formed externally on the upper end of the mixing chamber, is provided with an inlet and two outlets—one of the latter leading to the mixing chamber and the other to the pilot lights. The supply pipe is inserted at the upper end of the receiving chamber; a T-shaped union screw with a valve seat formed in it being threaded into the wall of the receiving chamber; while a cone-tipped valve screw-threaded into the union at the outer end is secured in the downward extension, for connecting the union with the downward extension from the mixing chamber.

Proportioning Gaseous Mixtures.

IONIDES, A. C., of Porchester Terrace, W.

No. 17,670; Dec. 17, 1915.

This invention relates to apparatus to enable the quality of a self-burning gaseous mixture to be judged by observation of a test burner—say, where a heating device is fitted with a plurality of burners each having separate adjusting devices and a combined main control. The invention further consists of photometric apparatus for estimating the strength of a self-burning gaseous mixture when consumed under regulated pressure conditions, and of apparatus for enabling the proportioning devices utilized in obtaining self-burning gaseous mixtures to be adjusted.

Two forms of apparatus suitable for carrying out the invention are shown on p. 118.

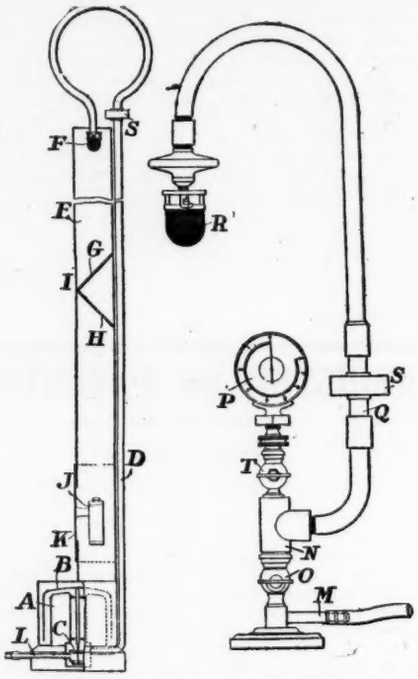
In the first, a double chamber A is provided with an ordinary bell gas-pressure regulating device B; the mixture being carried by a pipe L to the regulating valve C, and taken therefrom by a pipe D to the top of the apparatus. Upon the top of the chamber is fitted a hollow column E within the closed top of which is an incandescent burner F—such as an "inverted bijou" burner. The gaseous mixture flows through the pipe D and a back-flash extinguishing device S, preferably of the type described in patent No. 12,346 of 1912.

Within the tube E, near the middle, two mirrors G H, with their backs at right angles to one another, are inserted in an inclined position, so as to deflect equally any light travelling in a downward or upward direction through the tube H; light from opposite ends being deflected on to adjacent portions of a ground glass screen I inserted in one side of the tube in such a position that it receives the light deflected by the two mirrors.

To provide means for estimating the intensity of the light produced by the burner, a standard light J (such as an electric torch) is provided in the lower end of the tube, being fitted to it by a slide K so that its distance from the mirrors and screen may be varied and measured.

To use the apparatus, a mixture of known proportions and at a

pressure controlled by the bell B is consumed at the burner F as a guide light; and the standard light J is adjusted until the two portions of the screen I are equally illuminated—the position of the standard light for such equality of illumination being noted. The apparatus may then be removed to any position where it is desired to adjust the constituents of a mixture, where (upon regulating the separate valves controlling the conduits for the constituents of the mixture) a similar result in illumination may be obtained.



Ionides' Apparatus for Proportioning Gaseous Mixtures.

In some cases the standard light may be omitted and the proportions of the constituents of the mixture may be adjusted by reference to the intensity of the guide light only—due allowance being made for the combustion of the mixture occurring with some additional air and not in a closed chamber. Apparatus for this purpose is also shown. N is a standard having a connection piece M for conducting the gaseous mixture to it, and a tap O by which the supply may be adjusted. Upon the top of the standard is mounted a pressure gauge P. From N a pipe Q is taken upward and turned over at the top to carry an incandescent mantle R.

To operate with this type of apparatus, the tap T leading to the pressure gauge is fully opened, and the tap O is adjusted to give a moderate predetermined pressure—say, two-and-a-half tenths at the burner arm. By observing the luminosity of the mantle and adjusting the cocks for controlling the gaseous mixture until a maximum luminosity is obtained, a mixture giving about the maximum temperature of combustion is obtained—this being due to the fact that the temperature and luminosity curves for an incandescent mantle of the type indicated are very closely related.

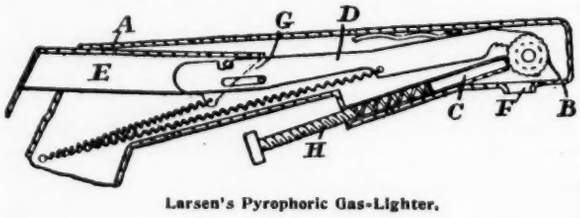
The apparatus last described is portable, and forms a convenient means for effecting the adjustment of the adjusting devices on a furnace or similar type of heating device where the use of a more elaborate testing apparatus is inconvenient.

Pyrophoric Gas-Lighter.—No. 101,717.

LARSEN, C. F., of Portland, Oregon, U.S.A.

No. 13,995; Oct. 2, 1916.

This pyrophoric gas-lighter is preferably in the form of a pistol. It comprises a support A for an abrasive wheel B engaging with a pyrophoric element C, and rotated by a pinion and rack-bar D, actuated by a sliding member E, which, after pushing the bar forward, becomes automatically disengaged from it. The bar is then withdrawn by a spring, thus causing the wheel B to rotate counter-clockwise and sparks to be emitted through an outlet F.



Larsen's Pyrophoric Gas-Lighter.

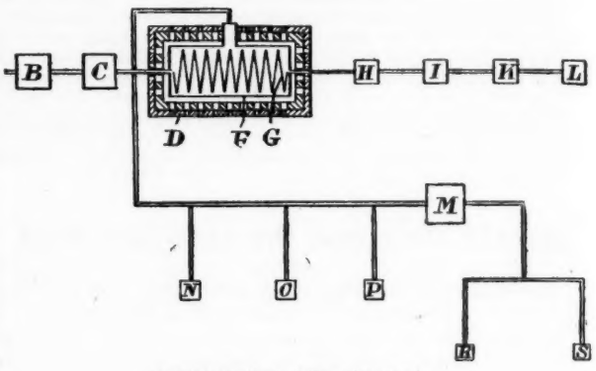
In the construction shown, a pin mounted in the support A, engages a slot in (and thus guides) the rack-bar. The member E (preferably of inverted trough-shaped section) is provided with a transverse pin engaging a notch in the rack-bar, so that when the member is pressed in, the pin forces the rack-bar forward until, by the engagement of the bevelled end G and the pin, the member E is raised and the pin leaves the notch. The element C is supported by a spring compressed by a screw H.

Treating Coal.—No. 101,539.

SMITH, C. H., of Short Hill, New Jersey, U.S.A.

No. 12,293; Aug. 30, 1916.

The patentee proposes to subject the coal to be coked to a preliminary heating, in order to reduce its volatile and moisture contents to the amount required for the successful subsequent production of coke.



Smith's Method of Treating Coal.

In the plant shown, the coal is passed through a crusher B to an oven F heated in a furnace D and provided with an agitator G—the temperature and duration of the heating being such as are necessary to effect the required reduction. The solid product is passed through a cooler I and crusher K to the coke-oven L; and the volatile products are drawn off by an exhauster M to tar, oil, ammonia, and benzene extractors N, O, P, and yield heating and illuminating gases at R S—the former gas being utilized (if desired) in the furnace D.

Gas-Fired Melting Furnaces.—No. 102,174.

HALL, I., of Aston, Birmingham.

No. 1072; Jan. 24, 1916.

According to this invention, two series of burners are provided in connection with the same furnace—one being atmospheric burners, while the other series consists of burners which depend upon a supply of air under pressure. Such an arrangement is said to be particularly advantageous where it is desired to melt metals of medium and low fusing points and also metals of comparatively high fusing point—for instance, aluminium and brass.

A convenient method of carrying out the invention is to have the furnace body comprise an iron shell lined with fire-brick to form a chamber for the crucible or melting pot. Radial apertures are formed in the furnace body to accommodate the nozzles of the burners; the one series of burners being either at a different height from the other series or in the same horizontal plane but arranged to alternate therewith. The gas supply for the two sets of burners may be arranged by the provision of a chamber of comparatively large capacity connected to the gas-main and arranged to feed the entire series of atmospheric burners, each of which is under control. Preferably a second series of gas supply pipes are connected to the reservoir to feed the pressure burners, the air supply of which is distributed by means of a similar reservoir which has an inlet and a series of outlets. The second series of outlets from the gas reservoir and the outlets from the air reservoir are individually controlled by taps.

When it is desired to melt metal of comparatively high fusing point, a plumbago crucible is used, and the pressure series of burners is employed; while for melting (say) aluminium, the taps for the pressure burners are shut off and the atmospheric burners are brought into operation.

Gas-Fires.—No. 102,626.

SCOTT-SNELL, C., of Wimbledon, and ANDERSON, D., of Gravesend.

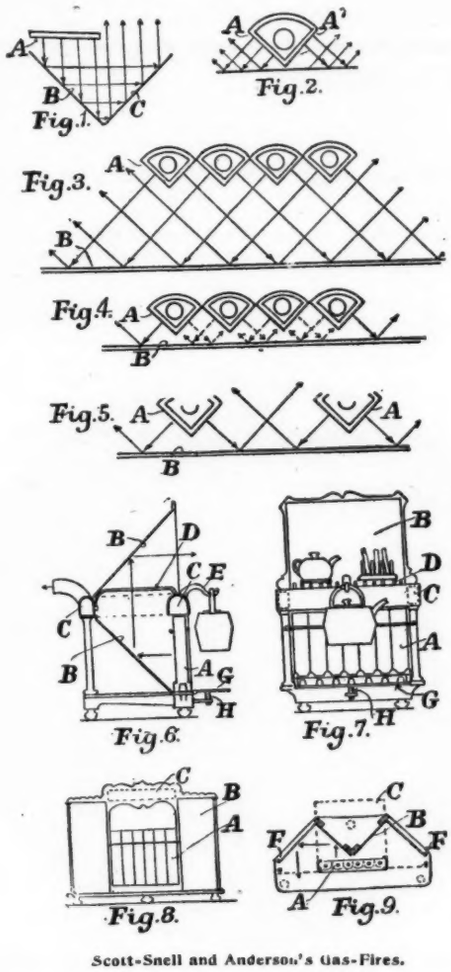
No. 106; Jan. 4, 1916.

This invention relates to gas-fires in which refractory material is heated in flames from bunsen burners, but without the usual fire-clay backings; the radiants being at a distance from, but in front of, heat mirrors, which "reflect forwardly or angularly the heat rays passing backwards from the rear parts of the radiants."

Fig. 1 (from the patentees' specification) shows how a heat ray emitted normal to a given face A, striking upon an inclined surface B, may be projected across to a second surface C, throughout following the law that the angle of incidence is equal to the angle of reflection. Fig. 2 shows how normal heat rays from two emissive surfaces A and A^1 falling upon a heat-reflecting surface are projected at angles complying with the above law. Fig. 3 shows how a series of radiants may deliver heat from the rear angularly into a room provided the heat reflector B be placed sufficiently far away. Fig. 4 shows how nearness of the reflecting medium would destroy the uninterrupted delivery of the heat—causing, in fact, a return of part of the heat to some of the radiants. [See dotted lines.] Fig. 5 shows how inter-

spaces between radiants may enable a close reflector to be used and still deliver normal heat rays uninterruptedly into the room.

Figs. 6 and 7 (section and elevation of a fire) show the heat being delivered above the radiants; the products of combustion being led around to the back by the flue C. A grid D may be added, and a kettle may be boiled by suspension from a horn E without undue heat to the handle. By an angularly adjustable lip G of reflecting material heat rays from the front of the fire may be adjustably deflected (by operating the screw H) to a higher level. Figs. 8 and 9 are a front elevation and plan of another form of the fire; the deflected heat being delivered at the sides. By releasing (say) a bolt at F the reflectors may be withdrawn sideways.



Scott-Snell and Anderson's Gas-Fires.

The radiants are marked A, and reflectors or heat mirrors B; the heat rays normal to the back faces of the radiants being delivered to the front as indicated by the arrows. These heat mirrors stand vertically after the manner of a four-leaf fire-screen; the central joint being immediately behind the centre of the row of burners. The two central planes are thrown back and the two outer planes are brought forward (after the manner of the letter M). But the relative angles of the planes are such that heat radiated perpendicularly to the back face of the row of radiants falls at 45° upon the adjacent plane, and is therefore reflected across to the outer plane, striking it at a similar angle, and from this into the room parallel with the heat rays from the front of the radiants but at the side. Thus the effective width of the fire is said to be doubled. The screen is made in two halves, and drops into grooves in the base or platform. From the platform rises a skeleton frame to carry the top of the gas-fire; and through this top passes the chimney.

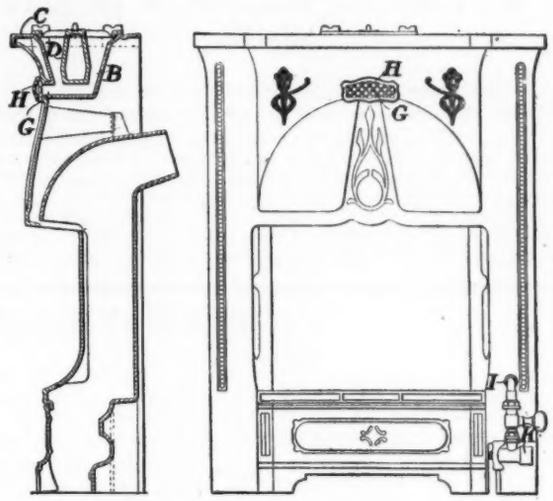
Gas-Fires.—No. 102,671.

DAVIS, H. N., and TWIGG, W. R., of Luton.

No. 5625; April 17, 1916.

The primary object of this invention is to provide a gas-fire with a top boiling burner so arranged that the flame "will not be detrimentally affected or drawn down by the pull or draught from the fire or chimney."

As shown, the fire (of any convenient construction) is provided with a well or basin B formed integral with the top plate C. A burner D is so arranged in the well that all the air required for combustion is obtained from the enclosed space provided by the well. It passes to the well from a lower side duct or passage G which connects the side of the well with an inlet opening H in the front of the stove. The pipe I, leading to the burner mixing tube, passes through the side of



Davis and Twigg's Gas-Fire.

the well and is fitted with a nipple adapted to co-operate with the open end of the atmospheric burner tube. The pipe may conveniently be connected to the main supply tube K as shown.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Jan. 10.]

Nos. 1—324.

ALEXANDER, W.—"Piston packing for pistons of gas-meters, &c." No. 132.

ALLMAN, D. W.—"Gas water-heaters." No. 81.

ASHTON, H.—"Adjustable shade for gas lights." No. 10.

BALLINGALL, J. M.—"Method of treatment, and utilization, of gases supplied to furnaces of hydrogen retorts." No. 290.

DEMPSTER, R. & J.—See Ballinghall. No. 290.

EMBLEM, O.—"Cocks or valves." No. 19.

FAIRBROTHER, H.—See Allman. No. 81.

HEYL, G. E.—"Production of carburetted water gas." No. 252.

IONIDES, A. C.—"Formation of combustible gaseous mixtures." No. 268.

KILBURN, B. E. D.—"Continuous distillation of tar." Nos. 77 and 78.

PINCHBECK LIMITED.—See Alexander. No. 132.

SULZER FRÈRES SOC. ANON.—See Kilburn. Nos. 77 and 78.

VARLEY, G. P.—See Emblem. No. 19.

WILSON, L.—"Gas-burners." No. 211.

APPLICATION FOR RESTORATION OF LAPSED PATENT.

Notice is given that MARGARET THORP, FRANKLIN THORP, CLIFFORD THORP, and HARVEY THOMAS THORP have made application for the restoration of the patent granted to THOMAS THORP, FRANKLIN THORP, and HARVEY THOMAS THORP, for an invention entitled "Improvements in and relating to indicating mechanism applicable to meters," No. 25,008 of 1911, dated Nov. 10, 1911.

Price of Coal in Germany.

According to "Engineering," as in England, there has been a somewhat protracted struggle going on in Germany between the coal-mining interests and the Government on the prices for coal, coke, and other kinds of fuel. The producers have been anxious to raise their quotations, and the authorities have been equally desirous of keeping prices at their present level. After lengthy negotiations in the Ministry for Commerce, in which producers of coal in all districts and of all kinds of coal have taken part, the latter have apparently gained the day—a general rise in quotations having been sanctioned and promptly declared. It may be noted in this connection that the Government hardly possesses any strictly legal right to control the prices for coal, saving a veto of the Prussian Crown within the Rhenish-Westphalian Coal Syndicate, against a rise. But during the war a custom has obtained of subjecting quotations to the approval of the Prussian Ministry of Commerce, which in case of need could fall back upon the threat of a decree enforcing maximum prices. . . . The authorities, to begin with, were against any rise in the quotations for fuel; but the coal mine owners produced such convincing figures as regards the higher cost of production that the authorities had to revise their views. Sixty coal-mining concerns (of divergent kinds and magnitude) showed that, on an average, the cost of production had increased as much from the spring to the fall of 1916 as during the whole of the preceding time of the war.

At the last meeting of the Middleton Town Council, the question of shortage of labour was discussed; and the Gas Engineer was authorized to engage women for sorting coke at 5½d. per hour.

OIL-PRODUCING QUALITIES OF AMERICAN SHALES.

Investigations made by the United States Geological Survey go to show that, whenever economic conditions necessitate or justify the distillation of shales, the Green River formation in Colorado, Utah, Nevada, and Wyoming can be made to yield vast quantities of oil, gas for use in the process of distillation, and fertilizer enough to enrich most of the farms of the Middle West. Hitherto the quantity and price of the natural yields of petroleum from the oil-fields have discouraged the shale industry, though in Colorado alone there are beds richer in oil than the Scotch shales, at least 3 ft. thick, capable of yielding 20,000 million barrels (or more than five times the production of the United States up to date), and also 300 million tons of ammonium sulphate. The yield of oil is 42 gallons and upwards per ton; and a thin bed at one locality furnished 90 gallons, or more than four times the quantity obtained from a ton of average Scotch shale. The industry requires a large and costly equipment, and probably could not be profitably organized on a small scale.

A rich shale is very tough, resists erosion, will burn when ignited, and when freshly broken gives off an odour of petroleum. Although large quantities of oil may be extracted by destructive distillation, probably not more than a small part exists as such in the shale; and oil is not obtained in commercial quantity from wells that have been drilled in Colorado.

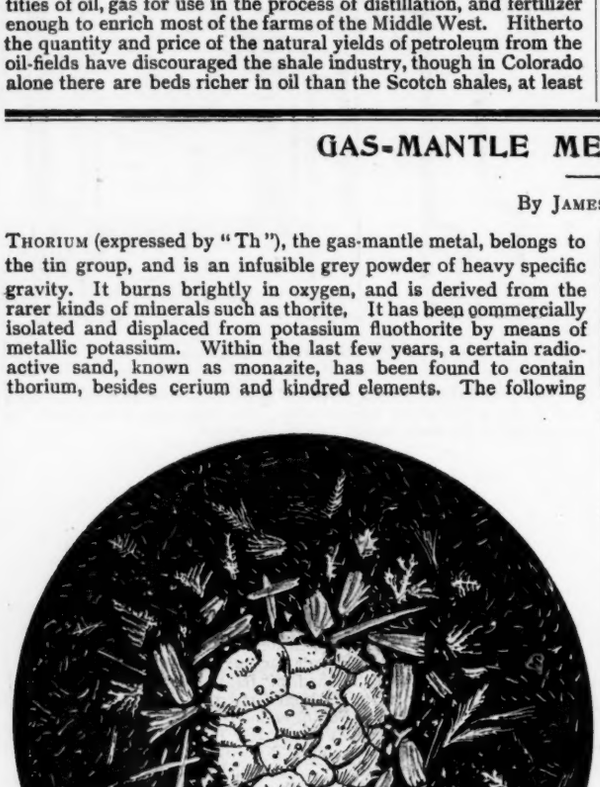
GAS-MANTLE METALS.—THORIUM.

By JAMES SCOTT.*

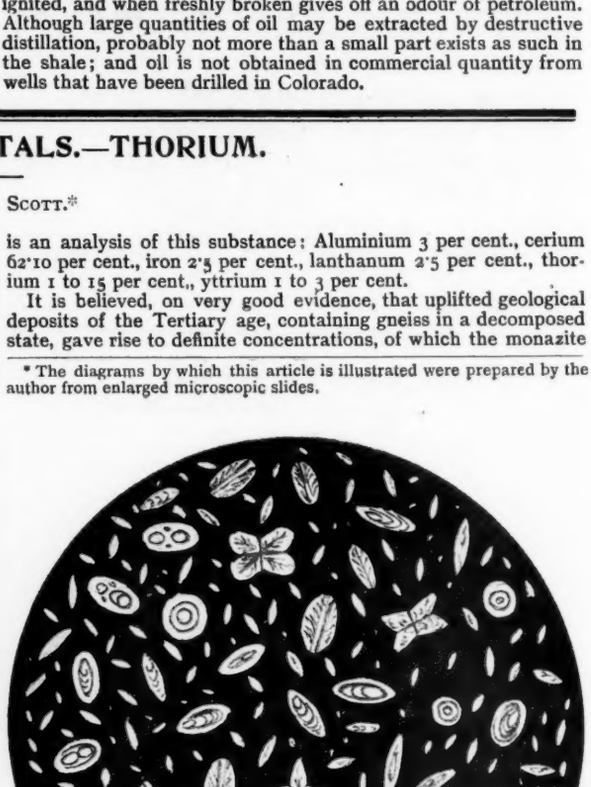
THORIUM (expressed by "Th"), the gas-mantle metal, belongs to the tin group, and is an infusible grey powder of heavy specific gravity. It burns brightly in oxygen, and is derived from the rarer kinds of minerals such as thorite. It has been commercially isolated and displaced from potassium fluothorite by means of metallic potassium. Within the last few years, a certain radio-active sand, known as monazite, has been found to contain thorium, besides cerium and kindred elements. The following is an analysis of this substance: Aluminium 3 per cent., cerium 62·10 per cent., iron 2·5 per cent., lanthanum 2·5 per cent., thorium 1 to 15 per cent., yttrium 1 to 3 per cent.

It is believed, on very good evidence, that uplifted geological deposits of the Tertiary age, containing gneiss in a decomposed state, gave rise to definite concentrations, of which the monazite

* The diagrams by which this article is illustrated were prepared by the author from enlarged microscopic slides.

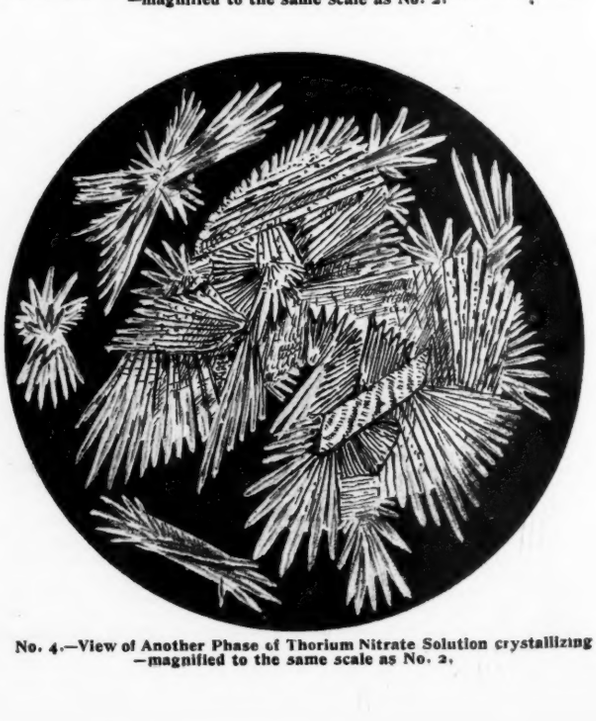


No. 1.—View of a Particle of Thorium Nitrate (in the centre) dissolving in Water. The surrounding objects vanish rapidly—seen in a space equal to a pinhole magnified.



No. 3.—View of Another Phase of Thorium Nitrate Solution crystallizing—magnified to the same scale as No. 2.

No. 2.—View of a Thorium Nitrate Solution crystallizing in a space equal to a pinhole greatly magnified.



No. 4.—View of Another Phase of Thorium Nitrate Solution crystallizing—magnified to the same scale as No. 2.

sand is the direct outcome. The weathered and worn result was washed down by rivers, along the banks of which some of it consolidated; while the remainder was carried out to sea and cast upon the coasts. Brazil possesses by far the largest quantity of this valuable product. Indeed, some computations point to this particular supply as being far in excess of the whole quantity to be found in other parts of the world.

The reader may be reminded that the composition of the original gas-mantle invented by Welsbach, and still forming the basis of improved kinds, consists of 1 per cent. of cerium and 99 per cent. of thorium, or salts to yield this proportion. It has been already stated that both cerium and thorium are converted into a nitrated compound by the action of nitric acid, and that into this fluid the small conical nets, usually made of cotton thread, are dipped; afterwards being withdrawn and thoroughly dried. Heat decomposes this nitrate into the oxide, which is responsible for the evolution of the brilliant incandescence.

Thorium nitrate is revealed as a very remarkable substance when microscopically investigated. In the dry condition it is a white powder, very soluble in water. When thus treated it will remain indefinitely clear, transparent, and syrupy; but upon heating the fluid the water is driven off and an opaque white substance reappears. The continuance of a high temperature resolves this into the incandescent oxide.

It will be advisable to detail the actual results of my experiments with this important substance. When magnified, the dry thorium nitrate exists as a shapeless mass of granules; but it possesses a well-formed structure, and can be obtained in several crystalline states, as will be shown later on. Some of it was placed on the upper end of an erect carbon rod, and then the flame of a blow-lamp was directed upon it. Within a short time it expanded considerably in bulk; some of the particles lengthening and twisting like the old-fashioned toy pills known as Pharaoh's serpents. Meantime, it glowed with a beautiful, dazzling intensity, proving that it had been decomposed into the oxide, which was afterwards found to be insoluble in water. The oxide remained as purely and densely white as the nitrate when the heat was removed. If the dry nitrate is moderately heated on a glass slide it will melt, and produce a conglomeration of tiny bubbles, many of which will be arranged in very symmetrical order.

If the various processes of change are watched through the microscope, a wonderful sight is witnessed. It is extremely difficult, however, to arrange for the incandescent state to be observed in this way; but the substance can be transferred on to a glass slide soon after it has been oxidized. It will then be learnt that during the heating the nitrate is melted and modified into a mass of minute cohering bubbles, the individual swelling of which is responsible for the general bulkiness of the consequent oxide. The oxide is designated ThO_2.

Some of the nitrate was next dissolved in water, disclosing meantime some very attractive results. The granules of white powder consist of agglomerated spheres, angular particles, and so on; and as they dissolve in the solvent there float away from them slender prisms, raphides, feather crystals, and the other forms depicted in fig. 1. These do not, as a rule, remain intact for more than a second or two, but become smaller and smaller, till they entirely vanish.

It has already been stated that this aqueous solution will remain unchanged at ordinary temperatures. Upon heating it, however, some marvellous developments arise. A few drops of the diluted nitrate were held for a few moments on a glass slide over the top of a lighted lamp, and they dried into a milk-white film. When this was magnified, it was seen to consist of a collection of minute globules, around which creases and folds gave pretty effects. Later on, moisture was attracted from the air, and the film began to dissolve. Then hosts of little crystals of the kind shown in fig. 2 sprang up. These were quite transparent when viewed by reflected light, which gives a clear back or bottom ground. To apply the proper degree of contrast, it is necessary to confine the illumination within limits, so as to afford a dark or black base. The crystals continually alter, and eventually become redissolved. During experiments of this kind it is advisable to heat the thorium nitrate solution, so that a small amount of it remains fluid while a surrounding crust is present. In such a case there will be an inexplicable diversity of crystal designs. When the nitrate solution is heated so that most of it is caked into an opaque white condition, the result will appear through the microscope as a mosaic-like film, from the borders of which will project, and elongate—or "grow," as it were—fan-tufts and kindred forms, Fig. 4 is a fair representation. Fig. 3 is an intermediate form.

Suppose one is looking down the microscope at a heated solution, there may at first be discernible minute crystals, almost too faint for notice. Eventually, they become more pronounced, and strongly defined; fig. 2 being a delineation of them. Soon they become jagged at the edges, and cracked over the surfaces, and then get smaller until they disappear.

By pushing the slide along, so as to bring into view another portion, we find that it consists of films of the kind shown in fig. 4; in between them being smaller crystalline flakes, probably like those in fig. 3. These, too, gradually break up, and are replaced by a mere transparent solution. The whole of the nitrate may be heated so that the result is a sort of patterned, unbroken, film. It is really possible to give a dozen illustrations of various modifications, and still not exhaust the possible changes; but the most typical and attractive disclosures have been depicted.

Among the variety of designs that occur in the heated nitrate will be found very neat serpentine ones. Sometimes hosts of figures will spring up instantly, vanish, reappear, and vanish again, and go on in this alternating manner for some time. The crystals finally become very distinct and fairly lasting, or fade away altogether without recurrence, according to the strength of the nitrate solution and the degree of heat which has been applied to it. Effects may be varied by repeating the heating.

The incandescence of the oxide can be well shown by using this nitrate. When the writer is experimenting, he dips a small piece of clean rag into the solution made by dissolving the thorium nitrate in water. Then the fabric is withdrawn and dried. Afterwards, if it is laid on the top of an upright carbon rod, and the flame of a blow-lamp is focussed upon it, the unsoaked fibres will be immediately consumed, while the treated portion will glow with a striking intensity—the nitrate having been changed to the oxide meantime. If the whitened result is left undisturbed, the incandescence can be repeatedly demonstrated. The addition of the right proportion of cerium nitrate to the thorium nitrate makes the experiment more interesting.

Our Weights and Measures.

This is the title of a pamphlet written by Mr. Allan Granger, for the purpose of drawing attention to some suggestions which he has to offer for the simplification and improvement of the Imperial system of weights and measures. He has realized, as other people have done, that to entirely change our system of weights and measures would mean a serious disturbance of trade customs and social habits, as well as involving a large expenditure; and therefore he suggests a partial change—something which, while open to less objection on the score of the magnitude of the various disadvantages, would still bring us very much nearer to the metric system. As we gather, he does not advocate this as being the better, so much as being the only practical, course to urge; and it is likely the argument, the possibility of which he foreshadows—that "all or nothing is the only sound policy to adopt"—may be the one raised with regard to his proposals, both by the advocates of the metric system and by those who support existing scales. It is because the results of past endeavours in this country to effect an improvement would seem to indicate that a complete change is not realizable, that he has been led to consider whether, in the interests of simplicity and convenience, any partial reform of the Imperial system is desirable and practicable. The difficulty of bringing about even the modified changes suggested, the author admits; but he thinks the effort worth while. His proposals are based on a new pound weight equal to the ½ kilogram, which means an increase of practically 10 p.ct., and a new gallon, to be likewise increased by 10 p.ct., making it roughly equivalent to 5 litres, or ½ decalitre. Linear, square, and cubic measures he would leave as at present. The pamphlet, which is published at the price of 6d. by Messrs. Eyre and Spottiswoode, Ltd., of East Harding Street, E.C., puts clearly and concisely a thoughtful contribution to this discussion of a question which has long exercised many minds.

The Illuminating Engineering Society will meet to-day, at the Society of Arts, to discuss the "Lumen as a Measure of Illuminating Power." The discussion on the subject will be opened by Prof. J. T. Morris.

A meeting of the Yorkshire Junior Gas Association will be held on Saturday of this week, in the Gas Department Mess Room, Dewsbury Road, Leeds, when a paper will be read by Mr. E. A. Leask, entitled "Town's Gas for Industrial Furnaces."

The meeting of the Midland Junior Gas Association at which Mr. T. F. E. Rhead, M.Sc., of Birmingham, is to submit his paper on "Chemical and Physical Problems connected with the Extraction of Benzol and Toluol from Coal Gas," has been postponed until Thursday evening, the 25th inst.

Members of the Scottish Junior Gas Association (Eastern District) will next Saturday afternoon visit the Cupar Gas-Works. Mr. J. Macpherson (the Engineer and Manager) will describe the vertical retorts recently installed there; and, on the invitation of the Directors, the visitors will, at the close of the inspection, be entertained at tea.

The Minister of Munitions has issued an order prohibiting the use of magnesite and magnesite products for, or in connection with (1) the construction or repair of any building (other than a furnace) or any flooring, or (2) the manufacture of any insulating or non-conducting material, except under a permit granted by the Minister of Munitions.

Mr. Bernard Orlando Clark, of Tettenhall (Staffs.), who died last October, at the age of 66, left estate of the gross value of £83,941. He was in business as an ironfounder, and was Chairman of the Wolverhampton Gas Company. The will has been proved, at the gross amount of £9556, of Mr. W. H. Bale, of the firm of Bale and Hardy, who died on Nov. 10.

Factory lighting again is the subject of the January issue of "A Thousand-and-One Uses for Gas." An illustrated article on "Modern Gas Lighting in Textile Mills" is reprinted from the "Textile Recorder;" and there is a contribution, also with photographs, by Mr. Leon Gaster, the Hon. Secretary of the Illuminating Engineering Society, on "Industrial Lighting and the Work of the Illuminating Engineering Movement."

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

War Loan.

SIR,—It is to be hoped that, following the lines of Mr. Bonar Law's eloquent and urgent appeal, those responsible for large and small gas undertakings—company or corporation—will do all they can, directly or by the "Subscription by Borrowing" advised in the important article in to-day's "Times," to swell the nation's funds. The possible objection as to want of statutory power, or the amount of indebtedness to banks already existing, may surely be disregarded in the contingency of this war. Bankers are empowered to lend on the security of the loan-scrip on terms which make the risk practically nothing to themselves or to the companies or corporations so borrowing—the intention being obviously to spread the loan over the widest possible base.

What profit can there be in any of our concerns if the war be lost for want of funds? It is no longer a case of weighing and balancing assets and liabilities or other possibly more advantageous financial courses. It is victory or slavery.

Personally I shall urge every undertaking that I can influence to go solid for the loan as far as our banks advise us, and they are least of all likely to lead us astray.

HY. E. JONES.

Palace Chambers, Westminster, S.W.
Jan. 13, 1917.

P.S.—We have done our best for war service in men and munitions; we must not stop at finance.

Restrictions in France.

SIR,—It is not often one has occasion to find fault with the "GAS JOURNAL;" but I think I ought to call your attention to the omission of the word "daily" in the twenty-fourth line of the first column of p. 59, under the above heading, without which the paragraph remains meaningless.

The new law (according to the circular of the Police Prefect of Paris, published in the "Temps" of Dec. 21 last) clearly stipulates that the basis consumption shall not exceed 1 cubic metre of gas or 3 hecto-watts of electricity *daily*.

Articles 3 and 4, I think, are interesting. The former allows a margin of 10 p.ct., and the latter provides that, if this margin is exceeded, the gas or electricity supply will be cut-off for a number of days, on the following scale:

Excess of 11 to	40 p.ct., ten days.
,, 41 to	75 p.ct., twenty days.
,, 76 to	100 p.ct., thirty days.
And over	forty days.

In such cases, the supply would be closed by a seal, the unauthorized breaking of which by the consumer might involve, not only legal prosecution, but also the cutting-off of the supply for the duration of the war.

ROBERT W. WILSON.

21, *Austin Friars, E.C., Jan.* 10, 1917.

Science in Education.

SIR,—The leader in your issue of the 9th inst., entitled "The Value to Industry of Science in Education," hits the nail on the head with a resounding blow.

As the preaching of this gospel is all too rare, I was somewhat surprised by your vigorous sermon until I noticed the unfamiliar text "Gas Journal—Light, Heat, Power, Bye-Products." Then I understood.

"As it was in the beginning, is now, and ever shall *not* be," is evidently the motto hung over the editorial desk.

A. PHILIP ALLAN.

Scarborough, Jan. 11, 1917.

Profit-Sharing Schemes.

SIR,—I shall be glad to know if any of your readers have been able, in connection with a small gas company, to construct any form of "profit-sharing" based on the recent financial issues of the Government—such as War Savings Certificates, &c.; and if in any way such could be used to the mutual benefit of employed and employer.

CONSTANT READER.

Jan. 12, 1917.

Bradford Gas Fatality.—A gas poisoning tragedy occurred at Bradford, on Monday of last week, and, strangely enough, it was at Eccleshill, a suburb which has recently been somewhat prominently associated with gas fatalities. Rowland Davidson, on returning home from work at breakfast time, went upstairs to see his wife, who had been ill for some time. She was lying in the empty bath with a gas-pipe in her mouth; and a doctor, on arrival, found she was dead.

East Grinstead Council and the Calorific Standard.—In connection with the application of the East Grinstead Gas and Water Company to the Board of Trade for an Order under the Gas (Standard of Calorific Power) Act, 1916, the Council intimate that, among other things, they desire a standard not lower than 540 B.Th.U., a pressure at least equal to the pressure now given, not above 10 per cent. of nitrogen and carbon dioxide, the substitution of the Boys calorimeter for the one proposed, opportunity for revision of the Order two years after the war ends, some safeguard as to the price of gas, and also that the Company shall at their own expense replace all flat-flame burners now in use with an approved burner constructed for use with gas supplied under a calorific power test.

MISCELLANEOUS NEWS.

SOUTH SUBURBAN CO-PARTNERSHIP.

The Sliding-Scale Provisions.

The following message of the Directors of the South Suburban Gas Company to the co-partners (signed by the Chairman, Mr. Charles Hunt) appears in the "Co-Partnership Almanack" for 1917.

The old year has left behind it an undesirable legacy in the shape of a reduction of bonus to 2 p.ct., the lowest rate paid since the establishment of profit sharing, except for the year 1901, when the bonus was also 2 p.ct. It can hardly be necessary to explain that this unwelcome drop from the pre-war rate of 7½ p.ct. follows, under the scheme of co-partnership, the advance which had to be made in the price of gas to cover the greatly increased cost of manufacture under war conditions—an advance which also governs the dividend, which is now the smallest on record, in consequence of the alterations made in the Company's sliding-scale provisions by their Act of 1906. Prominent among these alterations, and of principal importance as affecting this question, is: (1) The addition of 10d. to the amount by which the dividend is affected for every alteration of 1d. per 1000 c.ft. in the price of gas, making this 3s. 4d., instead of 2s. 6d. p.ct.; and (2) the substitution of a 2s. 9d. standard price, without a neutral zone, for the previously existing one of 2s. 10d., with a neutral zone up to 3s. 2d. Hence the present charge for gas carries with it a dividend less by 3s. 4d. p.ct. than when the same charge was made in 1901; the bonus to co-partners remaining the same. It seems desirable that the position in this respect should be clearly understood, because all co-partners are also proprietors, and will, it is to be hoped, increase their holdings as time goes on.

So far as can be at present foreseen, no further increase in the price of gas should become necessary; this having been averted—although narrowly—by recourse to Midland coal, which fortunately became available for the current year's supply. But it is clear that reduction of price, with its attendant increase of dividend and bonus, must depend largely, if not entirely, upon a return to more normal conditions—in other words, upon the issues of the present momentous struggle. To this we are happily able to look forward with ever-increasing confidence. May the New Year bring happiness to all!

SOUTHPORT CORPORATION GAS-WORKS.

Annual Report.

At the Monthly Meeting of the Southport Town Council last Tuesday, the report of the working of the gas undertaking for the year ended March 31, 1916, prepared by Mr. John Bond (the Engineer), was submitted on the minutes of the Gas Committee.

Mr. DUCKWORTH, the Vice-Chairman of the Committee, in the absence of the Chairman (Mr. T. Richardson), in moving the adoption of the report, said there had been a decrease in the consumption of gas amounting to 30,170,700 c.ft. compared with last year's figures. This decrease had been owing to circumstances over which neither the Committee nor the staff had had any control. The prepayment system of gas supply now amounted to 17·71 p.ct. of the whole sale, and showed an increase of 5·38 p.ct. above last year's figures. The average price received for all gas supplied amounted to 2s. 7·15d. per 1000 c.ft. This was 1·97d. per 1000 c.ft. over last year. The total capital expended per 1000 c.ft. of gas sold was 10s. 4·36d., against 9s. 11·10d. for 1915. The capital outstanding per 1000 c.ft. of gas sold was 5s. 8·74d., against 5s. 7·68d. for 1915. The gross profit for the year was £20,753; and after paying £11,938 towards the interest and sinking fund, there remained a net profit of £8815. It was proposed by the Town Council that £11,000 should go towards the relief of the rates, which left a debit balance of £2185 to be carried forward. They had, Mr. Duckworth remarked, in the gas estate, a sound asset for the borough of Southport. On capital account they had expended by March 31 last £307,003. The gas making material used was as follows: Coal, 51,483 tons—a decrease of 367 tons; oil, 926 tons (308 increase); coke, 2222 tons (385 increase). The maximum and minimum makes of gas during 24 hours were 2,489,000 c ft. and 1,160,000 c.ft. respectively. The amount of gas made was 629,672,000 c.ft. The gas sold to private consumers was 550,961,000 c.ft.; for private and public lamps, 37,185,200 c.ft.; used on works and offices, 9,843,200 c.ft. Free gas amounted to 318,000 c.ft. For the Ainsdale sewerage works, 4,000,000 c.ft. of gas was supplied; leaving 27,364,600 c.ft., or 4·34 p.ct., unaccounted for. The sales of gas (net) amounted to £76,378, which showed a decrease of £1045. On the other hand, they had sold in residuals £22,751, which showed an increase of £4236. Other items of income showed reductions as follows: Rents, £39; cookers and gas-fires, £181; public lamps, services, &c., £128; shop lamps, £812. On the expenditure side, carbonizing materials cost £9281 more than last year, and wages, &c., for gas making cost £935 increase. They had made 7100 gallons of benzol, which was a new departure. The engineering staff had had to face certain difficulties to produce this; but they had overcome them. They would find from this that while they had had less revenue from some things they had increased it in others. There was a minute authorizing the Gas Engineer to engage such female labour as he might consider necessary to act as meter inspectors, at 25s. per week. They had lost 65 of their staff, and they hoped that female labour would help to fill the gaps caused by the war.

Alderman TROUNSON, an ex-Chairman of the Committee, in seconding, said there was one feature of the report to which he had been bound to call the attention of the Town Council year by year. They had thought fit to go beyond the recommendation of the Gas Committee as to the amount that should come out of the profits for the relief of the rates. The Committee came to the Council last year and suggested £10,000 in relief of the rates. The Council said they were going to ignore this, and were going to have £11,000. This had been done for

the second or third year, with the result that they had put a millstone hanging round the neck of the Gas Committee. The onus must rest with the Council, not with the Gas Committee. The latter asked the Council not to do it. But they persisted, with the result that things were much blacker than they anticipated; and instead of a profit of £11,000 they finished up with a deficit of £2184. The increase on the gas sold was brought about simply by the 10 per cent. increase in the price; and had it not been for the increase of £4236 in residuals, the Gas Committee would have come before them that night with a deficit of £8466 on the year's working. He hoped that in future the Council would not make the mistake of not listening to the Committee, and hanging a millstone round their neck, such as had been round the neck of the Electricity Committtee for years.

The minutes and report were then passed.

REDUCED CONSUMPTION AT OLDHAM.

Alderman H. Wilde, J.P. (the Chairman of the Oldham Corporation Gas Committee), referred at the last meeting to the decrease in local gas consumption since March, 1916, and to the necessity for encouraging manufacturers and householders to avail themselves more freely of the advantages offered by the Corporation. The decreased consumption up to Jan. 8 [from March 25, 1916] amounted to, roughly, 101½ million cubic feet, equivalent to 8·38 per cent. For the month ended Jan. 8, the make was slightly over 189 millions, compared with 197½ million cubic feet in the corresponding period of last year; the actual delivery of gas in the two periods being 185,982,000 c.ft., and 196,814,000 c.ft. This, he said, was a very serious decrease; and he pointed out that, with the reduction in the consumption, the distribution expenses were increased. Therefore they would have to try and cultivate a demand for more gas.

Mr. Arthur Andrew (the General Manager) alluded in his report to recent criticisms of the illuminating power of the gas, and said the Committee had decided to purchase, at a cost of 12s. 6d. per gross, a new flat-flame burner which was considered suitable for the district. These burners would be distributed free to consumers who made application for them. It was not suggested that the distribution should be limited to private consumers only, but that they should be supplied to mills and other workshops in the neighbourhood where the use of flat-flame burners was neceesary. The Committee approved the recommendation.

Coal deliveries were reported to be considerably better, both at the Higginshaw and the Hollinwood works.

Bankruptcy of a Tar Distiller.—At the Bolton Bankruptcy Court last week, Mr. Joseph A. Hutchinson, who formerly carried on business as a tar distiller in the town, was publicly examined. The statement of affairs revealed liabilities of £4756, with practically no assets.

THE CALORIFIC STANDARD IN CANADA.

Government Regulations.

The report for the fiscal year ended March, 1916, by Mr. J. U. Vincent, Deputy Minister of Inland Revenue of the Dominion of Canada, on the inspection of weights and measures, gas, and electricity, contains the following remarks with regard to the substitution of a calorific standard for the previously existing illuminating power one.

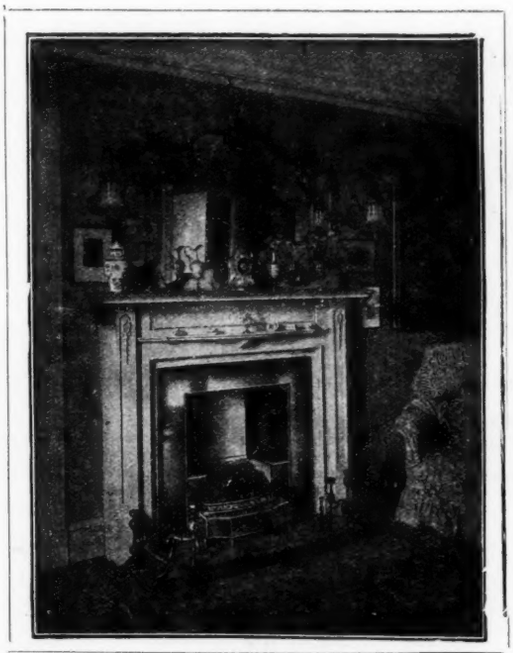
Prior to July 1, 1915, the gas companies were required to produce gas having an illuminating power of 16 candles. Owing to the changes that have taken place in the methods of using gas, this standard had become obsolete. Less than 5 per cent. of the gas manufactured was used in naked-flame burners for lighting purposes; the remainder, or over 95 per cent., being used in appliances which depended on the heating value rather than the illuminating power of the gas. This being the case, obviously the only course for the Department to pursue was to substitute a calorific standard in place of the candle power standard. This change was made by Order in Council, dated June 26, 1915; and the regulations in respect of manufactured gas became effective from July 1 of that year.

The regulations were reproduced *in extenso* in the "JOURNAL" for Sept. 7, 1915 [p. 498].

GAS FOR METAL MELTING.

An instance of the increased attention which is now being paid to the uses of gas in industry in the General Press was provided by yesterday's "Daily Telegraph," which contained the following reference to metal melting by means of gas-furnaces.

The melting of the metals which go to make the cupro-nickel alloy required for the envelopes of 0·303 bullets is a process which requires very careful handling. The alloy consists of copper and nickel. The copper, as is well known, readily oxidizes; while nickel is a metal much given to absorbing impurities from the products of combustion unless special care is taken during the melting. Some casters will first melt scrap cupro-nickel, then the copper, and finally add the nickel, which dissolves in the molten metal, thus forming the alloy. On the other hand, the copper and nickel are sometimes put in together. The nickel is not melted, but dissolves in the molten copper at a lower temperature than would be required for melting pure nickel. Cupro manganese is added at the end of the melt as a de-oxidizer; some means being provided for immersing this alloy below the surface of the metal in the crucible. The greatest care must be taken in the whole of these operations, as the melt is very easily spoiled. For this reason, gas-furnaces are particularly suitable for melting this alloy, as the heat can be rapidly



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attained, and the metal is not in the furnace longer than necessary, so that it has very little opportunity for absorbing impurities. As soon as the metal commences to melt, a cover is placed over the pot, to keep out the products of combustion and to protect the contents of the crucible as far as possible. Gas-furnaces are capable of exactly repeating these melting operations; and, unlike coke-furnaces, they can be timed to give melts at regular periods, because the fuel is under complete control by means of indicator-taps, which enable the proportions and quantities of gas and air supplied to the burners to be repeated time after time with absolute exactitude. By means of a patent furnace-burner brought out by a Birmingham firm, the heat required for melting cupro-nickel can now be attained by gas at ordinary town pressure with an air-blast of about 3 lbs. pressure; and standard furnaces are made to take crucibles of a capacity up to 250 lbs. of brass. Larger furnaces of the same type are made for melting brass, copper, and other metals and alloys, with crucibles up to 300 lbs. of brass, which is generally speaking the maximum for furnaces where crucibles have to be lifted out for pouring.

For melting cartridge metal and pouring it into strips for rolling, the latest development is a gas-heated tilting crucible furnace, in which the trunnions upon which the furnace body turns are in line with the lip of the crucible, which is of 600 lbs. (brass) capacity; so that as the furnace-body is tilted, the pouring-point is practically constant. By means of a turntable, or by a trolley running on rails in front of the furnace, moulds sufficient to take the whole contents of the crucible can be brought successively under the pouring point, and the crucible emptied with maximum rapidity. The furnace is tilted by means of chains attached to the front of the base of the furnace body and passing over sprocket wheels controlled by hand-gear to a counterbalance weight in the rear. When the furnace-body is down on the base-plate and the crucible charged before melting, a pre-heater is swung over it and lowered upon the top of the casing. A sleeve in this pre-heater corresponds with the opening of the crucible, and serves to extend it so that more ingots can be added to complete the charge. When it is required to pour the metal, the pre-heater is lifted clear of the furnace-body and slung out of the way.

FARMERS AND SULPHATE OF AMMONIA.

[From the "Journal of the Board of Agriculture."]

The likelihood of farmers having to depend almost exclusively upon sulphate of ammonia as a source of nitrogen until the end of the war, led the Board to institute an inquiry among farmers (through the medium of heads of agricultural colleges and agricultural organizers) as to their experience on various points with regard to the use of sulphate of ammonia.

Autumn Use of Sulphate of Ammonia.—Prominent among these points, was the question of autumn use of sulphate of ammonia. Last year the Board drew attention to the old practice of top-dressing wheat in autumn, and recommended that in certain cases farmers should revert to this practice in respect of part of the nitrogenous dressing. It was pointed out that, if the winter was moderately dry, and the spring dry and cold, autumn manuring would be likely to give the best results on poor land. The actual conditions experienced, however, were more favourable to spring dressings. Nevertheless, in the few instances where sulphate of ammonia was applied last autumn, farmers have expressed themselves as well satisfied with the results. Reports were received from seven farmers who had tried autumn applications only, and from a further six who compared autumn with spring applications. In regard to the autumn applications, the crops (except in one case—winter oats) were wheat. The applications were made between the end of October and December, at rates varying from ½ to 1¾ cwt. per acre; and the farms were in Yorkshire, Gloucestershire, Berkshire, Essex, and Wales. In five cases, the results were decidedly satisfactory. Where autumn applications were compared with spring applications, the reports were in favour of spring dressing in three cases, of autumn dressing in two cases (unfortunately in one of these more sulphate was used in autumn), and in one case there was no difference, despite a wet winter.

A report was received from Armstrong College of direct tests carried out on wheat at seven centres. At five of these centres, early winter or autumn applications gave better results than spring applications. The advantage was particularly noticeable at one centre where wheat was grown after oats.

Winter Applications.—In nine cases, reports were received of applications in winter, from the end of December until early in March; the quantities varying from 1 to 2 cwt., and the crops being wheat, barley, and oats. In every instance, the results were entirely satisfactory. Reports from several counties indicate that the month of January, when the plant was just coming through, proved a very suitable time for the application of sulphate of ammonia to wheat.

Spring Applications.—Some eighty farmers stated that they had used sulphate of ammonia in spring, in quaatities varying from ½ to 2 cwt. per acre, on wheat, barley, oats, hay, mangolds, swedes, turnips, carrots, mustard, and potatoes, and on a wide range of soils. The manure was generally covered-in at seed time or at planting, but in several cases was top-dressed, as late as June and July with mangolds. The general consensus of opinion was that the earlier the top-dressing, the better. In no single instance was an unsatisfactory result obtained; and in most cases a decided improvement was recorded. Several farmers insisted on the need for harrowing-in the sulphate.

Comparison between Nitrate of Soda and Sulphate of Ammonia.—More than fifty farmers ventured opinions as to the relative merits of nitrate of soda and sulphate of ammonia for top-dressing in spring; and in most cases these would appear to be based on actual experience. In Worcestershire, the majority of farmers preferred nitrate of soda for top-dressing cereals in spring, although sulphate of ammonia was used

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fairly extensively (with superphosphate) before drilling spring corn. The remarkable fact elsewhere was that only about one-quarter of the opinions were in favour of nitrate of soda. Nearly one-half were to the effect that sulphate of ammonia was to be preferred; while the remainder stated that there was very little difference between the two. Sulphate of ammonia was very generally preferred for cereals, potatoes, and roots.

The quickness of action of nitrate of soda is in some cases an advantage, enabling it to be applied later than sulphate of ammonia, at a time when the necessity (if any) of nitrogen for the crop becomes fully apparent. If it is a convenience to apply somewhat earlier in the year, the comparative slowness of action of sulphate of ammonia is a point in its favour. Sulphate of ammonia possesses the advantage that it may be applied at the time of sowing the spring-sown crops and harrowed-in. With a dry April and May, there may not be sufficient rain to wash the nitrate of soda in; and the latter manure may lie on the top of the soil until too late to be of use. A point in favour of nitrate of soda is that it is not affected by the absence of lime from the soil. Many of the excellent results quoted above with sulphate of ammonia were doubtless obtained by farmers who were large users of basic slag, or whose land from other causes was not markedly deficient in lime. It was mentioned in some instances that a better sample of grain—particularly barley—was obtained from the use of sulphate of ammonia than from nitrate of soda.

The report sent in by Armstrong College stated that sulphate of ammonia should probably not be applied as a top-dressing during frosty weather, especially if bright sunshine follows frosty mornings. Applications followed by damp, mild, growing weather will probably give the best results. Harrowing-in the sulphate of ammonia at the time of sowing wheat, or its application as a top-dressing before the young plants are showing through the ground, obviates this risk.

ADVICE TO FARMERS.

In the November issue, under the heading of nitrogenous manures, farmers were told that, in view of the difficulty of forecasting events, they would probably be well advised to lay in as much nitrogenous manure as they are likely to want during the coming season, and to allow liberal spring dressings for the corn crops. Several suitable kinds are available, sulphate of ammonia being the cheapest—the nitrogen being only a little over 15s. per unit; while nitrate of soda is the dearest—the nitrogen costing over 23s. per unit. Probable prices for nitrolim are returned from several of the markets, and are about 2s. per unit dearer than sulphate of ammonia.

These prices, it was added, do not show any kind of relation to the manurial value, as they are wholly determined by other considerations. From the farmer's point of view, if nitrate of soda is put at 100, sulphate of ammonia may usually be put at about 90, and nitrolim at about 85, when compared on a basis of equal nitrogen content. On the whole, then, sulphate of ammonia gives, at present prices, the best money value to the farmer.

UNIT PRICES OF ARTIFICIAL MANURES IN DECEMBER.

A statement in the December issue of the same "Journal" shows the cost to purchasers of 1 p.ct. per ton of nitrogen, and soluble and insoluble phosphates derived from various sources, at certain ports and manufacturing centres. The portion relating to nitrogen is reproduced.

It is pointed out that these unit prices are based on the probable retail cash prices for December, 1916, in bags, f.o.r., for quantities of not less than 2 tons of the manures mentioned at the ports and places specified; but it should be borne in mind that market prices are fluctuating considerably at the present time. The prices are published by the Board of Agriculture and Fisheries, for use in comparing the commercial values of artificial manures.

UNIT PRICES OF ARTIFICIAL MANURES.

	England and Wales.										Scotland.	
	London.	King's Lynn.	Hull.	Newcastle.	Silloth.	Liverpool.	Widnes.	Newport	Bristol.	Pymouth.	Glasgow	Leith.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Nitrogen from—												
Sulphate of ammonia pure 95 p.ct.	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	15 4½	..	15 6
Calcium cyanamide (Nitrolim) .	17 4	..	..	..	..	..	..	..	..	18 7	..	..
Nitrate of soda, pure, 95 p.ct. .	..	..	23 8½	..	..	24 0	24 8	..	23 6½	23 2½	..	22 7
,, ,, 90 p.ct. .	25 7½	25 4	24 0	..	..	..	..	..	24 4	24 8	..	..
Castor meal	..	23 7	21 7½	..	..	..	..	..	..	..	..	..

Supply and Control of Fertilizers.

The Food Controller announces that he has appointed a Committee to make such arrangements as may be necessary and expedient for the increase of supplies of fertilizers in the United Kingdom, and for controlling, as far as may be necessary, their output and distribution. Captain Charles Bathurst, M P., is the Chairman of the Committee.

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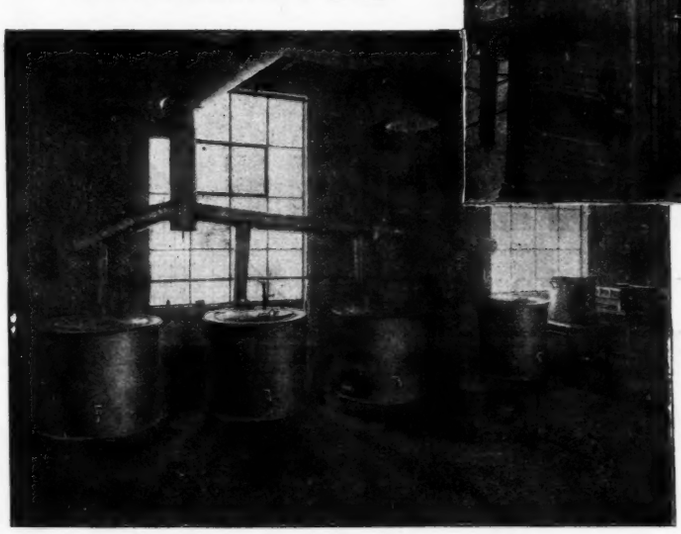

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CARBON MONOXIDE IN ILLUMINATING GAS.

At the Annual Meeting of the Royal Society of Canada, held in Ottawa in May, 1915, a report was submitted by a Committee appointed in 1914 to obtain information as to the "dangers to life arising from the presence of carbon monoxide in ordinary illuminating gas." It seems that in Canada a number of gas undertakings rely solely upon carburetted water-gas plant.

At the close of their report, the Committee recommended that the Department of Inland Revenue be requested to instruct their gas inspectors to determine the percentage of carbon monoxide in illuminating gas at the same time as they make the examination for sulphuretted hydrogen. In a subsequent report upon the subject to the Deputy Minister of Inland Revenue (Mr. J. U. Vincent), the Chief Engineer of Gas and Electricity to the Department (Mr. Ormond Higman) pointed out there is no similarity between the two tests.

Mr. Higman added that, even if all the carbon monoxide were removed from the gas, there would still remain deleterious elements sufficient to cause death by suffocation, if enough of it were inhaled. The use of gas for domestic purposes can hardly be made fool-proof; but doubtless something might be done to lessen the dangers arising therefrom. Manufactured gas is not the only gas that contains carbon monoxide. Natural gas, of which infinitely larger quantities are used than of manufactured gas, contains high percentages of carbon monoxide, and in some instances hydrogen sulphide, which is more subtle, for the reason that the poison is not destroyed during the process of combustion, as is the case with carbon monoxide. Is it contended that these poisonous elements should be removed from the gas? Such a course is altogether impracticable. It will not help us much to know whether the gas contains 10 p.ct. or 30 p.ct. of poisonous elements. The proper thing to do, in my opinion, would be to label it "Poison," and treat it accordingly. The difficulties complained of might be very largely eliminated by the use of proper appliances, and a close inspection of the plumbing by the municipalities. For cooking purposes, the gas might be used in enclosed ranges properly connected with ample flues to the chimney, and for lighting purposes by fittings that would admit of a sufficient quantity of air being mixed with the gas at the point of combustion. These are matters of local concern and belong exclusively to Provincial Legislatures and Municipalities.

On this, the Committee replied that, owing to the impossibility of obtaining proper statistics of deaths and injury from the use of the gas carrying a high percentage of carbon monoxide, and the increased development of its employment as a source of heat and power where the products of combustion and leakage are removed by pipes and chimneys, they considered that it was unwise at present to ask for legislative interference with its use. But they added that they were nevertheless "fully convinced of the danger to the community arising from the use of water gas and similar gases carrying a large quantity of the poisonous carbon monoxide; and even if the amount of this poison in the gas cannot be controlled by law, every municipality should be informed by frequent analyses as to the degree of danger from this source to which its inhabitants are exposed in using the public gas supply."

SWITZERLAND AND THE COAL-TAR DYE INDUSTRY.

The current issue of the "Journal of the Society of Chemical Industry" recalls that the coal-tar dye industry in Switzerland dates from the year 1859, when the manufacture of Perkin's mauve was started by the firm of Geigy, one year after the foundation of the British industry. The Swiss firm (established at Basle in 1764) had been engaged since 1856 in extracting natural colouring matters from woods, &c. The manufacture of fuchsin, discovered by Verguin in 1859, was started in Basle by the firm of Gerber-Keller in 1860, and was soon followed by the production of other dyes, many of which are due to the researches of Swiss chemists, Cornu, Graebe, Sieber, Durand, Sandmeyer, Schmid, &c. In 1866 there were four important dye factories in Switzerland—namely, those of Geigy, Gerber-Keller, and Clavel in Basle, and of Petersen in Schweizerhalle. In 1868 a fifth company was established near Geneva; but it ceased to make dyes in 1905. The firm of Petersen ceased to exist in 1908.

Switzerland ranks second to Germany among the dye-producing nations. In 1875 the value of the output of this industry was about 7,000,000 frs. In 1896 Swiss dye exports were valued at 13,910,000 frs.; in 1900, 15,342,000 frs.; in 1905, 20,014,000 frs.; in 1910, 25,414,000 frs.; in 1912, 25,753,000 frs.; and in 1915, about 29,000,000 frs. In connection with these figures it should be remembered that the value of the unit weight of dye produced is now only about 60 p.ct. of what it was in 1896; so that the increase in quantity manufactured is much greater than is indicated by the figures of value. More than half the exports in 1915 went to England.

The manufacture of synthetic indigo was commenced in 1911 by the Société pour l'Industrie Chimique; and in that year the exports were valued at 375,000 frs., in 1912 at 1,509,000 frs., and in 1913 at 3,910,000 frs.

The Hackney Electricity Charges Case.—At the last meeting of the Middleton Town Council, a letter was read from the Hackney Borough Council asking the Council to contribute a sum of £100 towards the costs of defending the action brought against them by the Gas Light and Coke Company for an injunction to restrain the Council from making a differentiation in the rates charged to consumers for electricity. It was resolved that the Hackney Council be informed that the Council are not prepared to give any financial assistance in the matter.

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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 15.

The position of pitch is maintained, and the price continues firm at 22s. 6d. per ton in bulk at works. Creosote is in good demand for various purposes; the price being unaltered at 4¼d. per gallon in bulk. Other values are: Solvent naphtha, 90-160, 2s. 3d. per gallon naked. Anthracene, 48-50, 3d. per unit, casks free. All prices are net cash at makers' works.

For sulphate of ammonia, there is a very strong demand for home use at official prices. For export, the price of 25 per cent. quality remains unchanged at £18 5s. per ton net in buyers' bags at makers' works.

Tar Products in the Provinces.

Jan. 15.

Markets for tar products are about the same. No business of importance is heard of in pitch. Solvent and heavy naphthas are steady.

The average values of gas-works products during the past week were: Gas-works coal tar, 19s. 9d. to 23s. 9d. Pitch, East Coast, 16s. to 16s. 6d. per ton; West Coast—Manchester 15s. to 15s. 6d., Liverpool 16s. to 16s. 6d., Clyde 17s. to 18s. Benzol, 90 p.ct. North, 10½d. to 11½d.; 50-90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 6¾d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 9d. Heavy naphtha, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 3⅜d. to 3⅝d. Heavy oils, in bulk, North, 3⅜d. Carbolic acid, 60 p.ct., East and West Coasts, 3s. 4d. naked. Naphthalene salts, 80s. bags included. Anthracene, "A" quality, 2¾d. to 3d. per unit; "B" quality, ¾d. to 1d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Jan.* 13.

Although the number of transactions has been small in the export market, the tone has remained steady during the past week, and values have been fairly well maintained. To-day's quotations for January delivery are unchanged at £18 15s. per ton f.o.b. Hull, £19 f.o.b. Liverpool, and £19 2s. 6d. f.o.b. Leith. In the forward position, business has also been restricted; but it has transpired that further sales have been made for January-December at about the current price for prompt delivery.

Nitrate of Soda.

This market has advanced further, and holders on spot now require 20s. 3d. per cwt. for ordinary quality and 20s. 9d. per cwt. for refined.

Sulphate of Ammonia.

From another source, to-day's quotations are given as follows: Outside London make, £17 7s. 6d.; Hull, £18 2s. 6d.; Leith, £18 10s.; Liverpool, £18 10s.; Middlesbrough, £18 5s. to £18 7s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The Northern coal trade is rather irregular; the steam coal branch being quieter through export difficulties, while for other classes the home support is fuller. In steam coals, prompt supplies are easier; but forward rates are well maintained. Best Northumbrian steams are 29s. to 30s. per ton f.o.b., second-class steams are 22s. 6d. to 25s., and steam smalls are from 17s. 6d. to 21s. The demand is good; but the difficulties as to export throw an occasional cargo on the market. In such cases, concessions in price follow. In the gas coal trade, the requirements are heavy, both for home and for export. Best Durham gas coal is 26s. to 28s. per ton f.o.b., second-class gas qualities are 20s. 6d. to 22s., and "Wear Specials" are from 32s. to 33s. There is a fairly-full production of gas coal, which meets the needs of the long contracts generally well. The output is being got away a little better than it was, as there have been steamers transferred to the coasting trade. Rates of freight for gas coal are still based on from 15s. 6d. to 16s. Tyne to the Thames. It is worth notice that the shipments of coal from the Tyne last year are shown officially to have been 790,000 tons less than during the previous year. The coke export, however, was just about doubled, though this is due mainly to the low supply of steamships for coal cargoes. Gas coke is quoted from 32s. 6d. to 34s. per ton f.o.b., according to the place of shipment; the demand being good. The latest freights reported for coke to French ports are 40s. Tyne to Dunkirk, and 42s. 6d. to Rouen, for moderate-sized cargoes.

Lighting Conditions in the Streets.—Referring to the existing lighting conditions in the streets of the Metropolis, a correspondent of "Municipal Engineering and Sanitary Record" thinks the urgency of the present situation offers some hope that the control of London's lighting from one central authoritative body may receive serious consideration. "There are," he says, "obvious defects in the present screening devices, notably the alternate patches of brightness and gloom. Another absurdity is the absence of any gradation in the amount of light allotted to different classes of streets; main thoroughfares and insignificant alleys being alike plunged into darkness. A general improvement in these conditions throughout London can only be secured by the adoption of a clear specification, and the existence of an authoritative central body to which any problems that arise in its application may be referred."

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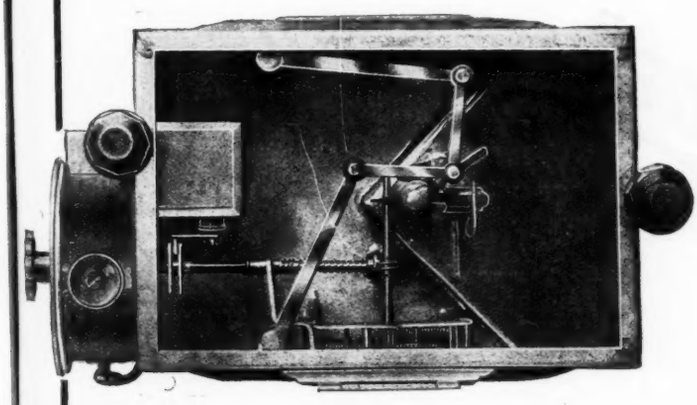

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Fire at the Warrington Gas-Works.

Fire broke out shortly after noon last Wednesday near the anthracene house at the Longford Gas-Works of the Warrington Corporation; and for about an hour there was a furious blaze, accompanied by dense volumes of smoke. The anthracene house is a one storey building, entirely roofed with a cast-iron tank, about 40 ft. × 15 ft. × 3 ft. deep, divided into six compartments. The conflagration started in a square cistern immediately adjoining the house; and one division of the tank caught fire. The heat caused several of the cast-iron plates to crack; two tanks of oil being lost, and three of the divisions seriously damaged. The building itself was practically fire-proof; and only the windows and woodwork were burnt out, and the girders supporting the tanks slightly buckled over one-half of the house, which is divided into two equal rooms with a blank wall. The fire brigade were promptly on the spot, and were fortunately able to prevent the flames from spreading to three large storage tanks, one containing benzol and two light oil and naphtha. The damage is estimated at about £250.

Tragedy in a Liverpool Hotel.—Two men who were staying the night at a Liverpool hotel prior to leaving for the United States, were given a room at the top of the house, and the gas was left burning. As they did not come down to breakfast the following morning, a servant was sent to call them. The room was found full of gas, and both men in a serious condition. Artificial respiration was resorted to; but in the case of one of them, it was unsuccessful.

Gas Consumption at Tottenham.—The "Tottenham Weekly Herald" says: It may be of interest to those who are shareholders in the Tottenham District Light, Heat, and Power Company to know that the consumption of gas during the year just expired exceeded that for 1915, notwithstanding the total abolition of public lighting by gas. This increase mainly occurred in the first half of the year, when the factories were working night shifts, which they ceased to do in the second half.

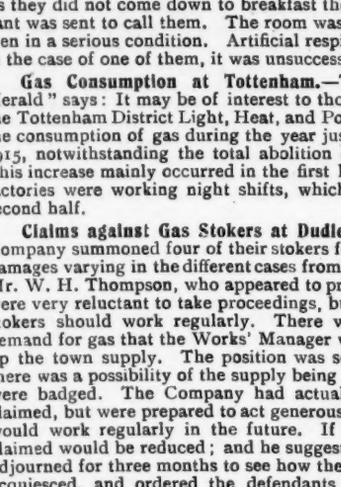
Claims against Gas Stokers at Dudley.—When the Dudley Gas Company summoned four of their stokers for neglect of work (claiming damages varying in the different cases from £3 5s. 6d. to £10 18s. 8d.), Mr. W. H. Thompson, who appeared to prosecute, said the Directors were very reluctant to take proceedings, but it was important that the stokers should work regularly. There was such an extraordinary demand for gas that the Works' Manager was at his wit's end to keep up the town supply. The position was so serious at Christmas that there was a possibility of the supply being stopped. Most of the men were badged. The Company had actually sustained the damages claimed, but were prepared to act generously to the defendants, if they would work regularly in the future. If they did so, the amounts claimed would be reduced; and he suggested that the cases should be adjourned for three months to see how the men behaved. The Bench acquiesced, and ordered the defendants (who admitted the claims generally) to pay the costs.

Capital Powers at Worthing.—At an extraordinary meeting of the Worthing Gas Company last Saturday week, a resolution was adopted authorizing the Directors to raise by way of loan capital any sum not exceeding £22,000. The Chairman (Mr. H. H. Gardner), who presided, said the circumstances were well known, and connected with the war. It was not a suitable time to issue perpetual obligations of any kind; and it was thought the requirements of the Company would be more prudently met by arranging a short term loan—probably seven years—at a higher rate of interest than they had been accustomed to, so that they might get rid of it when happier times returned and the value of money would probably not be what it is to-day. The capital had been expended on the new holder, &c., at Goring.

Curious Fatality at Carlisle.—An inquest was concluded at Carlisle last Wednesday on the body of Charlotte Bell, aged 56, who was found dead with her two cats on Boxing-Day, in the single room in which she lived by herself. It was believed death was due to poisoning; but no trace of any poison could be found in the house, and the analysis of the contents of the stomachs of the deceased and her cats failed to show traces of poison of any kind. It appeared, however, that there had been an escape of gas detected in the street on Christmas Eve; and the evidence showed that it was possible for the gas to have penetrated into the room in which the woman lived. The medical men agreed that the results were not inconsistent with the conditions that would have been set up by gas poisoning.

Tanderagee Acetylene Gas Supply.—A special meeting of the Tanderagee Urban Council has been held to consider what steps should be taken with regard to the gas supply of the town, owing to the Government action in prohibiting the supply of carbide except for their own purposes. The Clerk said the position was very serious, as it was almost impossible to obtain any carbide. He suggested that the gas should be cut off after 10.30 p.m. each night until 5 p.m. the following day; that they discontinue the public lighting of the town, with the exception of a few lamps; that a circular be issued to all consumers urging the strictest economy in the use of gas; and that the price be raised from 4s. to 6s. per 100 c.ft. After a lengthy discussion, the Council decided to carry out these suggestions; but it was agreed to keep the price as at present.

Calorific Test for St. Mary Church Gas.—It was decided by the Torquay Town Council at their last meeting to apply to the Local Government Board for an Order to substitute a calorific test of 500 B.Th.U. gross for the present illuminating power test of the gas supplied from the St. Mary Church Gas-Works, provided that sanction be obtained for a loan for the cost of the gas-washing plant required to secure the advantages of the Act. Mr. F. Chalmers (the Gas Manager) stated that the standard quality of the gas supplied was 14 candles, but during the lighting hours what was sent out was usually of 16 candles. He estimated the cost of the plant which would have to be installed at £300, and that the resulting crude benzol would bring in about £150 per annum, besides which there would be a saving of £500 a year in the cost of enriching materials.



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Improved Lighting at Burnley.—To the great satisfaction of the inhabitants, there has been very considerable relaxation of the drastic lighting restrictions insisted upon at Burnley since the winter begun. Previously, only a few lamps were lighted in two or three of the main thoroughfares; and these were extinguished about 11 p.m. The remainder of the streets were left in total darkness. It has, report says, now been discovered that the very meagre public lighting permitted during the past three months was that adopted by the Gas Committee for the summer, as a measure of economy in coal and gas. No extension of the lighting was made when the dark winter nights came.

Proper Utilization of Coal.—In a report to the Marylebone Council, on the question of the proper utilization of coal, the Manager of the Electricity Department—who has been ascertaining whether it would be possible to gasify coke in producers, extract the ammonia and convert it into sulphate, and fire the boilers with gas—states that he finds the capital cost which would be entailed would far exceed any saving that would be effected. The next best thing, and one which would be a long step in the direction of the proper utilization of coal, would be to fit two boilers with forced draught, which would work continuously on coke breeze and similar low-class fuels, or one or two could be fed with coke and gas obtained from the proposed distillation plant.

Wages and Allowances at Manchester.—The Parliamentary Committee of the Manchester Corporation have considered resolutions passed at a recent meeting of Corporation officials, requesting the City Council to grant a war bonus of 10s. a week to each official receiving up to, and including, £500 per annum. The resolutions expressed the opinion that the wages of many persons in the service of the Corporation, especially those receiving the minimum wage of 26s. a week, *plus* a war bonus of 4s., are totally inadequate in present conditions to ensure a reasonable standard of life. The Committee could not, however, see their way to recommend the Council to acquiesce in the employees' request.

Complaint of Low Pressure at Teignmouth.—Mr. Foster, a member of the Teignmouth District Council, complained at a meeting of that body yesterday week that alterations in the pressure of gas led to much inconvenience. Tradesmen had not sufficient gas between 5 and 6 p.m., and the gas went out at 11 p.m. Mr. J. A. Gray (the Gas Manager) said the intention at all times was to leave such pressure in the mains as would be adequate for the general requirements. If the pressure necessary for the lighting hours was kept on during the non-lighting hours, there would be increased loss by leakage. Where private lights were properly adjusted, there was not much fear of their going out when the pressure was reduced.

STOCK MARKET REPORT.

BUSINESS on the Stock Exchange last week might almost be written in two words—War Loan *et præterea nihil*. For the first four days in expectation, and for the rest in realization, it reigned supreme, and the general markets were completely overshadowed. Perhaps the most remarkable feature about it was that, in these days, when it is so easy—almost popular, indeed—to cavil at every act of a Government, it met with practically universal approval. Of course, a little detail here and there left an opening for some mild criticism; but the fact remains that the Chancellor has scored a big success. As regards the effect it had upon the different markets, the features varied considerably. Some were rendered torpid to a degree, and one or two were practically stagnant. In the gilt-edged market the terms of the loan were regarded as so liberal (some styled them generous) that values of existing issues had to undergo some writing-down to proportionate levels.

It may be noted that on Friday Consols touched 52¾—said to be the lowest figure for more than 100 years. On the other hand, the 4½ per cent. War Loan at last reached par, after a long struggle upwards, although it was always known that par was to be its value in payment for the new Loan.

Home Rails were a dull market; selling orders (perhaps to provide for loan applications) being the rule. Americans and Argentines were spiritless, and South Africans moved irregularly. The Foreign Market generally was firm—French, Russian, Chinese, and Japanese being the pick of the basket. In the Miscellaneous Market, banking announcements gave satisfaction, and shares responded. Textiles were firm, and Rubber was steady; but Oil and Ships were dull.

Business in the Gas Market was pretty good in the aggregate; but by far the greater part of it was confined to the Metropolitan companies, the rest mustering only about a dozen bargains altogether. Prices for the most part were about the same as the week before; but in one or two issues, there was some inclination to ease. In the Money Market there was a good supply; but rates closed firm.

Bargains done for cash during the week were as follows: On Monday, Commercial 3½ p. ct. 68, Gas Light ordinary, 72, 72½, Primitiva, 40s. 7½d., 41s. 3d., ditto preference, 60s. 7½d., 61s. 3d. On Tuesday, Gas Light ordinary 72½, 72⅝, 72⅞, Primitiva, 40s., ditto preference 61s. 3d., Guildford ordinary, 85½, 86. On Wednesday, Gas Light ordinary 72, 72½, 72⅝, ditto maximum, 56, 56⅛, 56⅜, Imperial Continental 76, Primitiva 41s. 6d., South Metropolitan 77⅛, 78, 78¼, 78⅜, 78⅝, 79½, South Suburban 81¼. On Thursday, British, 34¼, 34½, Commercial debenture, 52½, 53, Gas Light ordinary 72, 72½, ditto maximum 56½, ditto debenture, 56⅝, Newport 5 p. ct. 81½, South Metropolitan 77⅛, 77⅜, 78, 78¼, 78⅜. On Friday, European 10, Gas Light ordinary 71⅛, 72½, 72⅝, ditto debenture 57, Portsea "B" 94½, 95, Primitiva 40s., ditto preference 60s., South Metropolitan 77¼, 77¾, 78, Tottenham "B" 89, 89½. On Saturday, Gas Light ordinary 71½, 72, South Metropolitan 77⅞, Tottenham "B" 89, 89½.

The Bank rate is 6 per cent.—as fixed on July 13.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div on Ord. and Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
175,472	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	65—70	..
1,551,868	"	April 8	2½	5⅛%	Alliance & Dublin Ord.	59—64	62—64	..
374,000	"	July 10	4	4%	Do. 4 p.c. Deb.	76—79	58—63*	..
280,000	5	April 29	7½	4/6	Bombay, Ltd.	5⅛—6⅛	5—5⅛	..
50,000	10	Feb. 26	16	15/-	Bourne-mouth Gas and Water (10 p.c. / B 7 p.c. / Pref. 6 p.c. / 4 p.c. Deb.	29—30	25—27	..
383,110	10	"	7	7/-		15—15½	11—11½	..
115,000	10	"	6	6/-		13½—14	9½—10	..
159,740	—	—	—	4%		..	71—73	..
992,045	Stk.	Feb. 26	†14	55/-	Brentford A Consolid.	261—266	85—87	..
734,920	"	"	†11	53/9	Do. B New	204—209	82—84	..
55,000	"	"	5	5%	Do. 5 p.c. Pref.	109—111	85—90	..
221,400	"	June 11	4	4%	Do. 4 p.c. Deb.	91—93	67—69	..
217,380	"	Feb. 26	11	10½%	Brighton & Hove Orig.	208—213	160—165	..
244,200	"	"	8	7½%	Do. A Ord. Stk.	154—159	115—120	..
530,000	20	Mar. 26	12½	22/6	British	44—45	34—35	34¼—34½
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	66—68	..
245,771	"	"	4	4%	Buenos Ayres 4 p.c. Deb.	85—87	58—63	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	1½—1⅞	..
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	4½—5	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	58—63	..
157,150	"	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	82—83	..
1,513,280	"	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	78—75	..
560 000	"	"	5⅛	46/8	Do. 3½ p.c. do.	103—105	68—70	68
475,000	"	June 11	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	52—54	52½—53
800,000	"	"	4	—	Continental Union Ltd.	76—79	36—38	..
200,000	"	"	7	—	Do. 7 p.c. Pref.	115—118	58—60	..
278,400	—	—	—	11½%	Croydon B and C 7 p.c.	..	175—185	..
—	—	—	—	10%	Do. E	..	..	..
492,270	Stk.	—	6	5⅞%	Derby Con. Stk.	123—125	100—105	..
55,000	"	—	4	4%	Do. Deb. Stk.	102—104	80—83	..
1,032,180	10	July 29	10	7/6	European, Ltd.	17½—18	11—12	10
16,313 430	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke (4 p.c. Ord. / 3½ p.c. max. / 4 p.c. Con. Pref. / 3 p.c. Con. Deb. / 10 p.c. Bonds	98—102	71—73	71½—72½
2,600.000	"	"	3½	3½%		76—79	55—58	56—56½
4,062,235	"	"	4	4%		96—99	69—71	..
4,674 850	"	June 11	3	3%		72½—74½	56—58	56½—57
130,000	"	"	10	10%		..	..	..
2°8,740	"	Mar. 12	5	4⅛%	Hastings & St. L. 3½ p.c.	87—89	78—83	..
70 000	10	April 29	11	6%	Hongkong & China, Ltd.	16½—16⅝	8—9	..
86,600	—	—	—	9½%	Hornsey 7 p.c.	..	125—135	..
131,000	Stk.	Mar. 12	7⅞	7⅞%	Ilford A and C.	151—154	105—110	..
65,780	"	"	6⅜	5⅞%	Do. B	115—118	92—97	..
65,500	"	June 26	4	4%	Do. 4 p.c. Deb	92—94	71—74	..
4,910,000	"	May 14	9	4½%	Imperial Continental	150—160	73—78	76
1,235,000	"	Feb. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	65—67	..
235,242	"	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	87—92	..
2,498,905	"	Feb. 26	10	5%	Liverpool 5 p.c. Ord. (A / B)	211—213 / 146—148	85—87	..
306,083	"	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	74—76	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4⅝	3⅞—4⅛	..
250,000	100	April 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99—101	89—93	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	8½—8⅝	..
1,875,892	Stk.	July 29	4½	4½%	Newcastle&Gatsh'dCon.	98½—99½	79—80	..
529,705	"	June 26	3½	3½%	Do. 3½ p.c. Deb.	82—83	75—77	..
55,940	10	Feb. 26	7/14/0	7/8½	North Middlesex 7 p.c.	14—15	10½—11½	..
300,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	104—106	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅞	2—3	..
60,000	50	Feb. 26	13	12%	Portsea, Island B	128—131	95—100	94½—95
100,000	50	"	12	11%	Do. C	118—121	88—93	..
52,000	50	"	10	9%	Do. D	..	..	..
249,980	5	April 29	8	—	Primitiva Ord.	5⅛—6	2—2½	40/—41/6
499,960	5	June 26	5	2/6	Do. 5 p.c. Pref.	4⅝—5	3—3⅛	60/—61/3
521,600	100	June 2	4	4%	Do. 4 p.c. Deb.	91—93	78—80	..
—	—	—	—	4%	Do. " " 1911	..	..	..
346,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	85—87	61—67	..
150,000	10	May 14	6	6/-	San Paulo (6 p.c. Pref. / 5 p.c. Deb.	10⅛—11	8—8⅛	..
125,000	50	July 1	5	5%		47—49	42—44	..
135,000	Stk.	Mar. 12	10	10%	Sheffield A	223—224	168—192	..
209,984	"	"	10	10%	Do. B	222—224	188—192	..
523 500	"	"	10	10%	Do. C	220—222	188—190	..
90,000	10	May 28	9	6/-	South African.	10½—11½	..	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met. 4 p.c. Ord.	111—113	77—79	77½—79½
1,895,445	"	July 10	3	3%	Do. 3 p.c. Deb.	72⅛—74½	56—58*	..
221,820	"	Feb. 26	8½	8%	South Shields Con. Stk.	157—159	145—147	..
952,795	"	"	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	80—82	81½
60,000	"	"	5	5%	Do. 5 p.c. Pref.	110—112	79—81	..
185,000	—	—	—	48/4	Do. West Kent	..	..	..
187,558	Stk.	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	88—90	..
647,740	"	May 14	5	5%	Southampton Ord.	99—102	77—79	..
120,000	"	Feb. 12	7½	7½%	Tottenham District (A 5 p.c. / B 3½ p.c. / 4 p.c. Deb.	135—138	120—123	..
782,275	"	"	6	5⅝%		115—117	89—91	89—89½
181,255	"	June 26	4	4%		87—89	65—67	..
189,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	60—65	..
236,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p.c. max.	108½—109½	91—92	..
					Wandsworth, Wimbledon, and Epsom—			..
30,000	"	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	117—122	..
255,636	"	"	6¼	63/9	Do. B 3½ p.c.	129—134	101—103	..
108,075	"	"	5/17/3	55/1½	Do. C 3½ p.c.	110—115	88—93	..
352,000	"	"	6¼	57/6	Wimbledon 5 p.c.	117—122	90—95	..
98,000	"	"	6⅜	63/9	Epsom 5 p.c.	121—126	98—103	..
88,416	"	June 26	3	3%	3 p.c. Deb. Stk.	66—69	51—54	..

* Ex. div. † Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

Gas-Works Deficit at Ellesmere.

A question was asked by one of the members at the last meeting of the Ellesmere Urban District Council as to the cause of a deficit of £441 on the gas account. In reply, the Clerk stated that the debit was considerably increased by cheques they had to pay that day, one of which was for income-tax. Then there was the cost of public lighting, some £260, for which, of course, they had no return, and which would come out of the general account. Another thing was that a short time ago the Council decided to reduce the cost of gas to consumers by 6d. per 1000 c.ft , although he at the time called their attention to the danger of adopting this course. As a matter of fact, during last year there had been two reductions of 6d. each ; and the cost to consumers was now 3s 6d. per 1000 c.ft. The Gas Manager (Mr. F. Ashley) said it did not pay to sell gas at 3s. 6d. They charged less for gas in Ellesmere than in any other place in Shropshire. Several works of similar size to those at Ellesmere charged double the price. The Clerk pointed out that there had been a great increase in the price of coal ; and there was the cost of public lighting, which came out of the rates. Each year they had to have a subsidy out of the rates to carry on the gas undertaking. It was decided that Mr. Ashley should present a report at the next meeting, showing the cost of production.

Calorific Power in the Local Papers.—A Kent paper, referring to the application of the Tonbridge Gas Company for a standard of calorific power, announces that "the Orders under the recent Public Act prescribe 15-10ths of an inch as the standard of calorific power." Another provincial paper lately stated that a local undertaking had applied for a standard of 5000 B.Th.U. We live and learn.

Death of a Soldier from Gas Poisoning.—It was stated at an inquest on the body of Percy Jackson, a trooper in King Edward's Horse, that he engaged a bedroom at a private hotel in Euston Square, and on the following morning was found dead in bed. A piece of tubing was attached to the gas bracket ; the other end being on the bed near Jackson's mouth. The ventilators of the room were stuffed with towels

Donations towards a proposed local War Hospital include the generous sum of £1000 from the Sunderland Gas Company.

At a meeting of the Stretford Urban District Council, the Clerk reported at length upon the application of the Gas Company for a Provisional Order authorizing an extension of their works, and recommended conditions for acceptance by the Company, subject to which the Council's consent might be given. This was agreed to.

There was an exciting scene in Victoria Street, Liverpool, last Friday, when in connection with one of the electric mains there was a loud explosion, accompanied by a sheet of flame. A fire then broke out, and miniature explosions followed—portions of the pavement being thrown into the air. Fortunately, nobody was injured.

The Home Office are to be asked by the Cardiff City Council to receive a deputation, who will point out the need of the modification of the reduced lighting order in the Cardiff district. This decision was come to on the proposition of Sir John Courtis, who declared that innumerable accidents had taken place. Alderman Richards (the Chairman of the Watch Committee) said no more accidents than usual had occurred since the lights had been subdued.

In order to facilitate the carrying on of their business in Scotland, Messrs. Brotherton and Co., Limited, tar distillers, Leeds, have opened offices at No. 29, St. Vincent Street, Glasgow.

In reply to the request of the Local Government Board for information as to work available and likely to be undertaken at the conclusion of the war, the Halifax Corporation have sent particulars of work estimated to involve a total expenditure of £255,171. The urgent work includes new carbonizing plant at the gas-works, £20,000.

Mr. W. W. Topley, best known to readers of the "JOURNAL" as Secretary and Accountant of the Croydon Gas Company, is part author, with Mr. H. D. Gower and Mr. L. Stanley Jast, of a book just published by Messrs. Sampson Low, Marston, & Co., Ltd., entitled "The Camera as Historian." It is a handbook to photographic record work for those who use a camera, and for survey or record societies ; and as bearing upon Mr. Topley's qualifications for the share he has taken in the preparation of the book, it may be mentioned that he is the Hon. Treasurer of the Photographic Survey and Record of Surrey.

At a sitting of the local Tribunal, the Hebden Bridge and Mytholmroyd Gas Board appealed for the retention of the services of Herbert Calvert, a gas-fitter, and Fred Sowden, a meter inspector. Mr. T. H. Nield (the Manager) based the Board's claim on the indispensability of the men. Conditional exemption was asked for Calvert, as the only man available to attend to leakages and repairs ; while Sowden was described as the only meter inspector in the Board's employ, there being nobody to replace him. Calvert was put under reserved occupations, and Sowden given conditional exemption so long as he occupies his present position.

At a sitting of the Elland Military Service Tribunal last week, Mr. R. Porter, the Manager of the Elland Gas Company, appealed for William Crowther, fitter and tinsmith, F. W. Sheeran, fitter and plumber, and Arthur Brearley, meter inspector. He said they were indispensable and the only men left in their departments. The work was four months behind owing to shortage of labour, and men of their experience could not be obtained at the present time. Brearley had to look after 6500 meters. Any further reduction of staff at the works would mean the curtailment of gas production for power purposes. Exemption to March 31 was granted—the men to be medically examined in the meantime.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office has issued the following order :

> The public are informed that newspapers and other printed publications will not be sent to Neutral European Countries unless posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral European Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "JOURNAL" has obtained the required permission of the War Office ; and he will, on receipt of instructions, forward copies direct from the office to any neutral country.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointment Wanted.

ENGINEER, MANAGER, AND SECRETARY. No. 6267.

Appointments, &c., Vacant.

ENGINEER. Tunbridge Wells Gas Company. Applications by Jan. 31.
ENGINEER AND MANAGER. Castleford and Whitwood Gas Company.
WORKS MANAGER. No. 6264.
WORKING FOREMAN. Ilfracombe Gas-Works.
CARBONIZING FOREMAN. No. 6266.
METER REPAIRER. Worthing Gas Works.
FOREMEN. No. 6263.
GAS-FITTERS. Worthing Gas-Works.
GAS-FITTERS. Bolton Corporation.
SHOW ROOM ATTENDANT. Slough Gas Company.

Plant, &c. (Second Hand), for Sale.

AMMONIACAL LIQUOR STILL. Robin Hood Coke Works, near Wakefield.
GASHOLDER. Dudley Gaslight Company.

Gas-Works for Sale.

CAWOOD GAS COMPANY. By Auction, Queen's Hotel, Leeds. Jan. 23.

Tank Waggons Wanted (Hire or Purchase).

No. 6251.

Carbon Wanted.

No. 6192.
No. 6261.
THOS. HILL-JONES, Limited, Bow Common Lane, E.

TENDERS FOR

Gasholder Repairs.

RAWMARSH GAS DEPARTMENT. Tenders by Jan. 24.

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